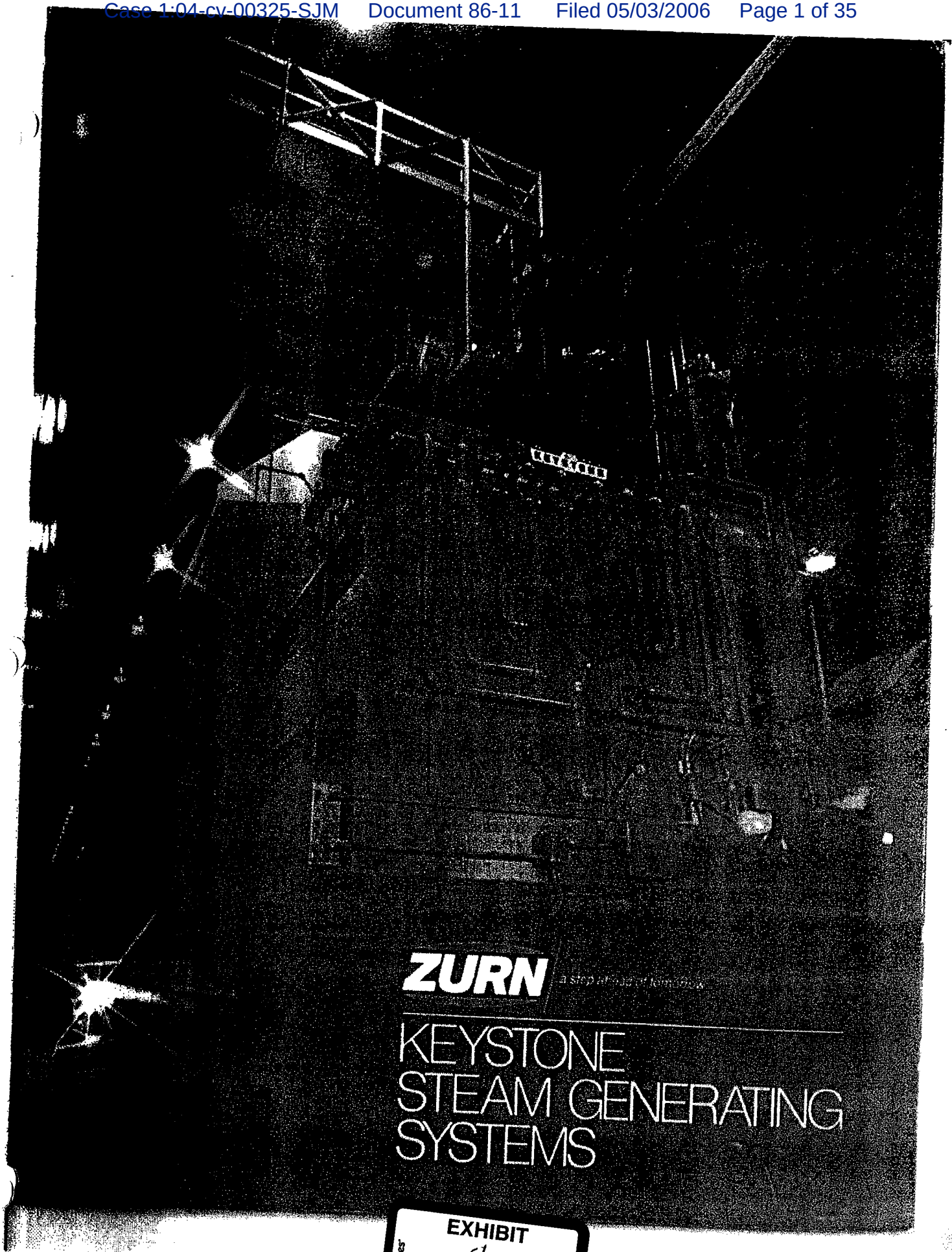
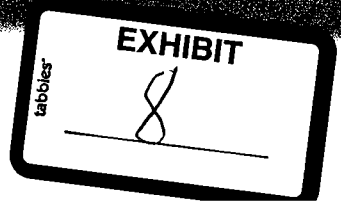


ZURN

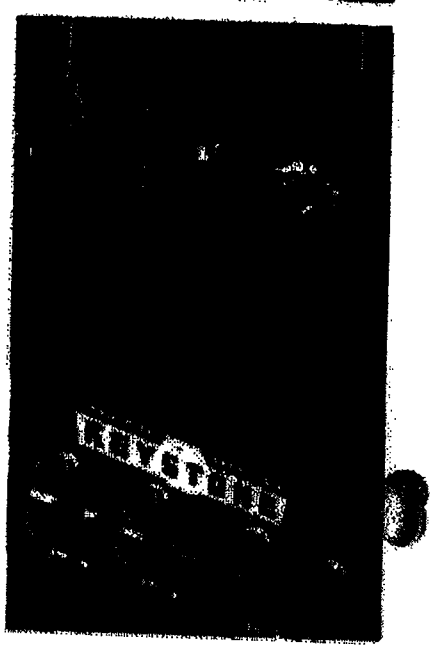
KEYSTONE STEAM GENERATING SYSTEMS



KEYSTONE:® HARNESSING STEAM ENERGY

Man has always strived to harness air, water, fire, and products of the earth to save his own energy and to perform useful work. Ever since the first century, when Hero of Alexandria utilized these elements to build a primitive steam reaction turbine, man has devised numerous ways of harnessing steam for energy. Through the centuries, man, in his quest for more capacity, more power, and more efficiency from the same vessel, improved and revised the use of steam for energy. History too, through the demands of the industrial revolution, forced man to abandon manual labor, the horse and the sail for better energy alternatives.

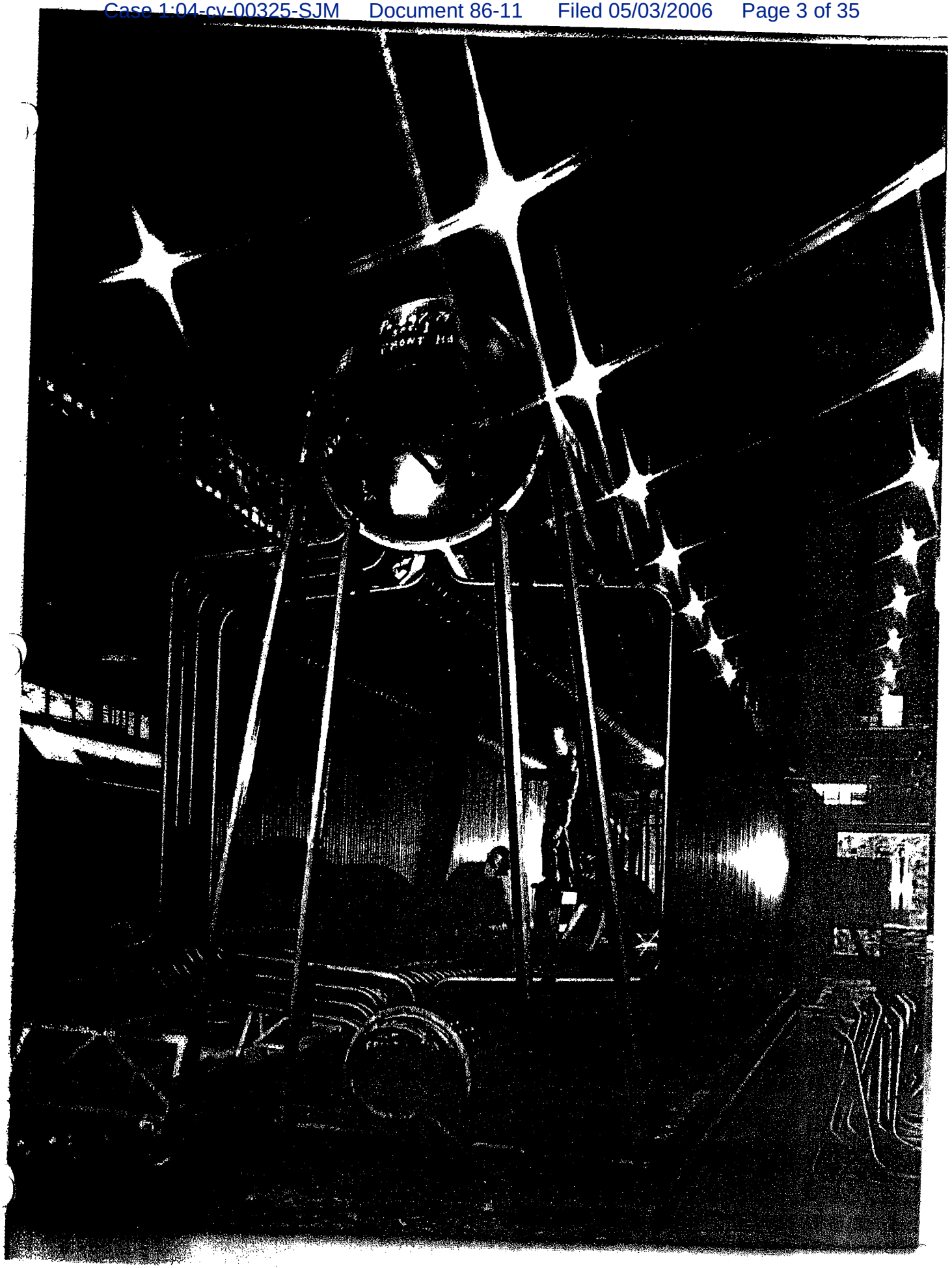
Zurn Industries, Inc., Energy Div. (formerly Erie City Iron Works), since its founding in 1840, saw its future in steam power. Throughout the years the Company was to meet demand after demand for its ever-expanding line of energy systems. In fact, the Company was to pioneer many developments in designing and constructing ways to harness steam energy. As demands grew, so did the steam capacity — and the steam generator moved from the factory to the field-erected version where space was not so limiting. But field construction costs and capital expenditures grew, too, and along with them the demand for higher capacity "package" steam generators. The Company responded with the development of the KEYSTONE Steam Generating System, a factory-assembled or modular field-erected energy "package" capable of producing 6,000 to 500,000 pounds of steam per hour and more. The KEYSTONE is symmetrical in design, easy to ship, install, operate, and maintain and is available in design pressures up to 2000 PSIG and total steam temperatures to 950° Fahrenheit. Custom-designed fuel burning systems provide the best method for firing gas and/or oil or for special applications such as utilizing carbon monoxide gases and a wide variety of other waste gases. Energy recovery and pollution control equipment complement the KEYSTONE for industrial, power, utility, and processing applications.



above
The KEYSTONE Steam Generator, a large capacity "package" unit, was developed to fill a critical void between large field-erected steam generators — which were time-consuming to assemble and costly to construct — and small factory-assembled steam generators which were limited in capacity.

right
The KEYSTONE — named after the key block needed to build an arch — ushered in a new generation of "package" energy systems.

right hand page
KEYSTONE construction begins with the drums symmetrically supported on a longitudinal centerline. Tube rolling begins with the center furnace tubes and ends with the outer side wall and rear wall tubes. This unique tangent furnace tube configuration provides for faster steam generating capabilities with lower furnace heat absorption rates. Once all tubes are in final position the unit is ready for hydrostatic testing at 1½ times the PSIG design pressure.



KEYSTONE: ENGINEERED AS A PACKAGE

All basic components of the KEYSTONE are the same – only the physical dimensions vary to meet the required operating conditions.

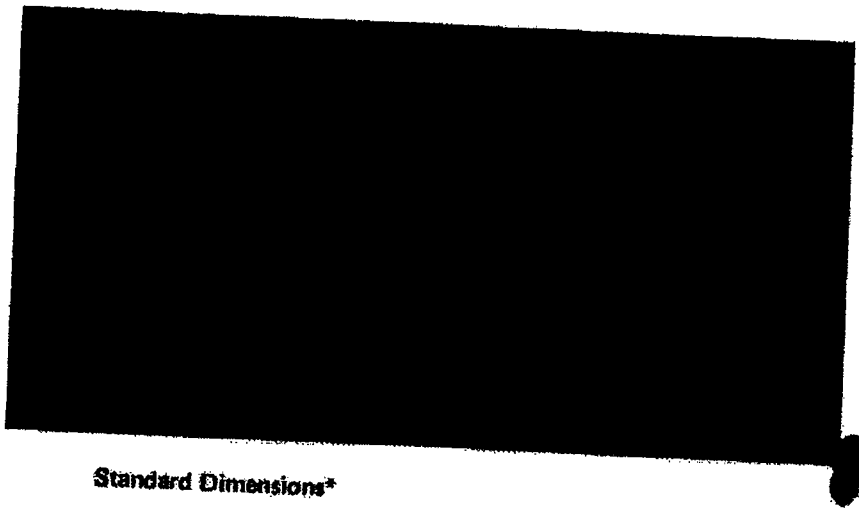
Single Responsibility
Zurn Industries, Inc., Energy Div. designs, manufactures, and services every basic component in the steam generator – burner, superheater, and heat recovery systems to assure the ultimate in customer satisfaction.

Minimum Space
The uniquely-designed KEYSTONE is very compact and requires a minimum of space. Foundation area and installation costs are minimized by mounting the stack on the KEYSTONE'S top front gas outlet.

Minimum Maintenance
The KEYSTONE has no refractory baffles, headers or handhole plates to maintain. All tubes are 2" O.D. throughout permitting the use of a standard tube cleaner. Rapid water circulation keeps sludge and scale deposits to a minimum. Manholes in both ends of each drum allow easy access to drum internals.

Pre-Engineered Piping Arrangement
Because each KEYSTONE is furnished as a total package, the piping module is perfectly matched to the steam generator. The steam generator is designed for easy hookup to fuel, water, and electrical connections.

Economical Operation
Pressurized firing insures accurate control of excess air. There is no infiltration of outside air to upset the preset fuel-air ratio. Result is better burner performance and thermal efficiency. The engineered system of modulating controls proportions fuel and air as the load requirement changes.

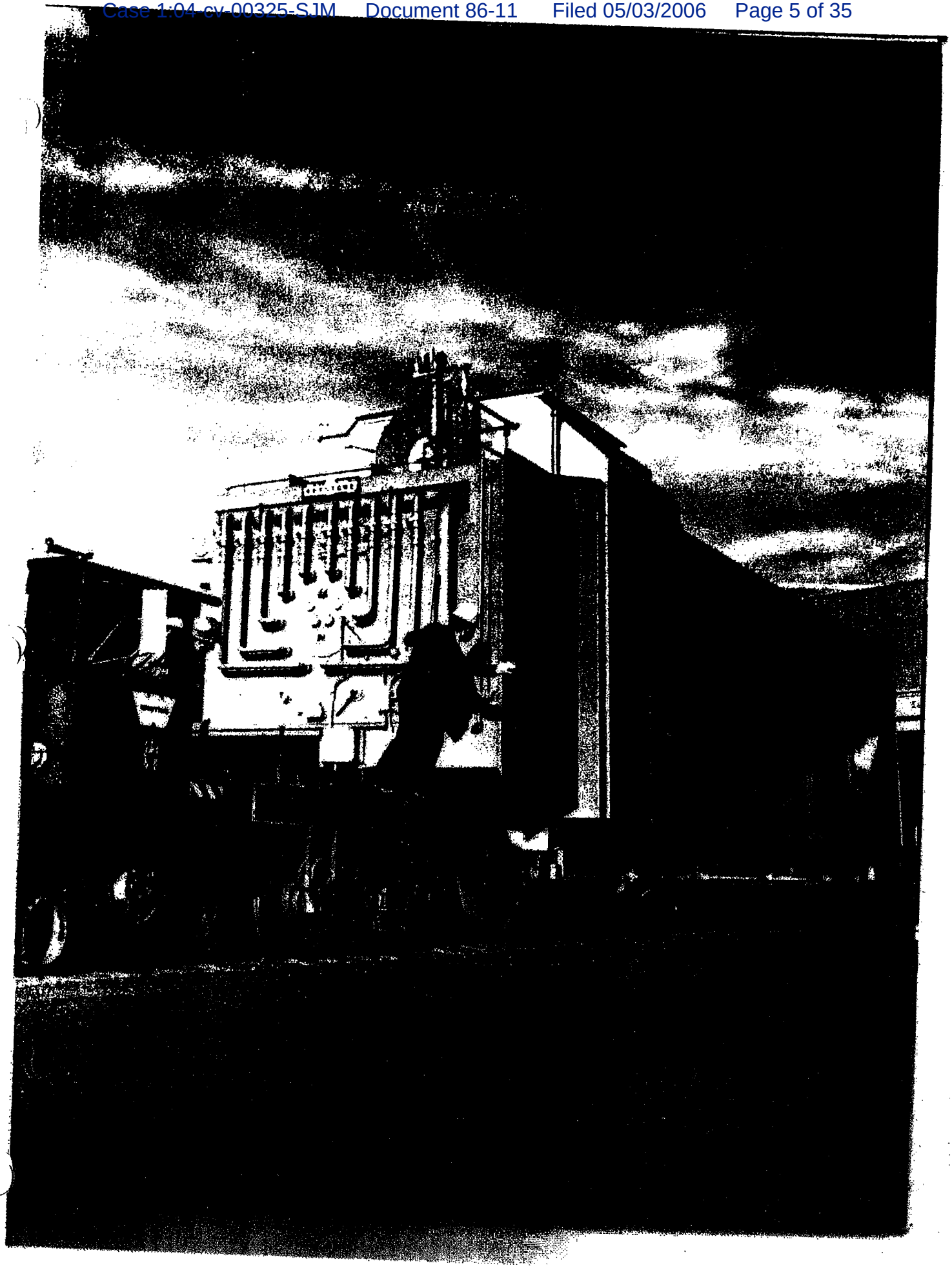


Standard Dimensions*

Size No.	A Overall Length	B Overall Width	C Overall Height	D Base Length
3M	15'-3"	7'-6"	12'-8¼"	9'-9"
4M	15'-11"	7'-6"	12'-8¼"	10'-5"
5M	17'-3"	7'-6"	12'-8¼"	11'-9"
6M	19'-3"	7'-6"	12'-8¼"	13'-9"
7M	19'-7"	9'-0"	12'-8¼"	13'-1"
8M	20'-7"	9'-0"	12'-8¼"	14'-1"
9M	22'-3"	9'-0"	12'-8¼"	15'-9"
10M	22'-5"	10'-0"	13'-3¼"	16'-1"
11M	24'-7"	10'-0"	13'-3¼"	18'-1"
12M	26'-7"	10'-0"	13'-3¼"	19'-1"
13M	27'-7"	10'-0"	13'-3¼"	20'-1"
14M	26'-0"	11'-6"	14'-0"	20'-5"
15M	28'-8"	11'-6"	14'-0"	22'-1"
16M	28'-8"	12'-0"	14'-6"	24'-1"
17M	29'-8"	12'-6"	14'-6"	25'-1"
18M	30'-8"	12'-0"	14'-6"	26'-1"
19M	32'-8"	12'-0"	14'-6"	28'-1"
20M	35'-8"	12'-0"	14'-6"	31'-1"
21M	37'-8"	12'-0"	14'-6"	33'-1"
22M	39'-0"	12'-2"	15'-6"	34'-6"
23M	42'-0"	12'-2"	15'-6"	37'-5"
24M	46'-2"	12'-11"	16'-0"	38'-5"
25M	49'-0"	12'-11"	16'-0"	41'-3"
26M	52'-0"	12'-11"	16'-0"	44'-3"

*Dimensions Subject to Change Without Notice

right hand page
Symmetrical design assures easy handling indoors or out.



KEYSTONE: DESIGNED FOR EFFICIENT ENERGY PRODUCTION

The unique design of the Zurn KEYSTONE offers uniform gas distribution, equal expansion and vertical flue gas outlet. The symmetrical arrangement and short furnace tubes offer lower heat adsorption and higher circulation ratios than other package steam generator designs.

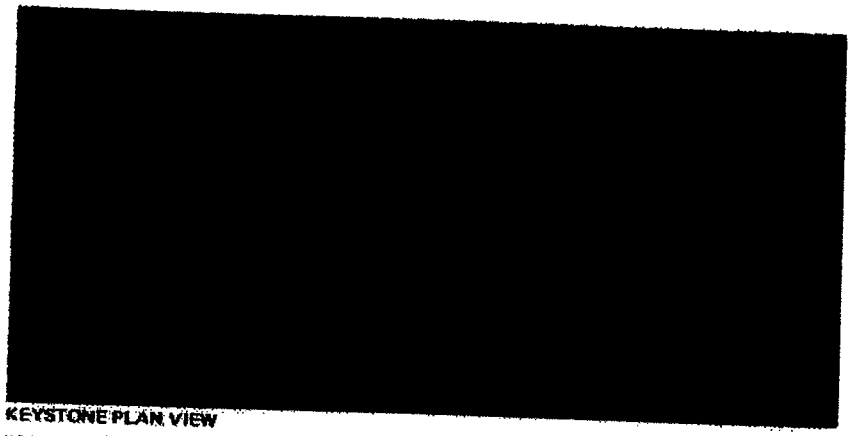
The KEYSTONE Steam Generator furnace is composed of all 2" tangent tubes on 2" centers forming a water cooled wall which directs the flow of gases from the front of the unit through the furnace and around both sides at the rear into the convection zones and toward the front of the unit with a top vertical flue gas discharge. (See Heat Flow Pattern at right.)

Heat Recovery Options

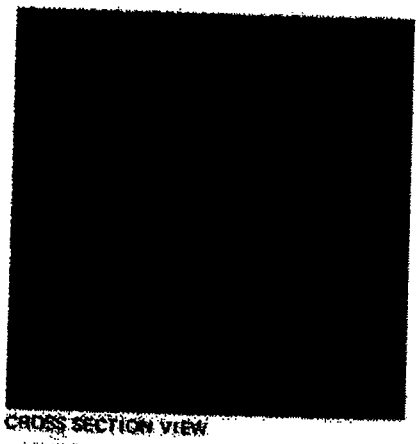
For maximum overall steam generator efficiency with low initial cost, the Zurn Energy Div. offers combinations of heat recovery equipment. This equipment and auxiliaries can be mounted on top of the steam generator, saving valuable floor space and eliminating the need for excessive foundations. Finned tube Economizers utilize often-wasted flue gas heat to increase feedwater temperature, thereby increasing efficiency and reducing fuel consumption. Tube and fin spacing within each Economizer are arranged for the particular fuel or fuels being fired.

Zurn also offers regenerative-type air preheaters as another heat recovery option. In the regenerative air preheat method heat from flue gas is transferred to incoming cold air by continuously rotating heat transfer elements. This greatly increases the temperature of incoming combustion air which maximizes fuel economy and operating efficiency.

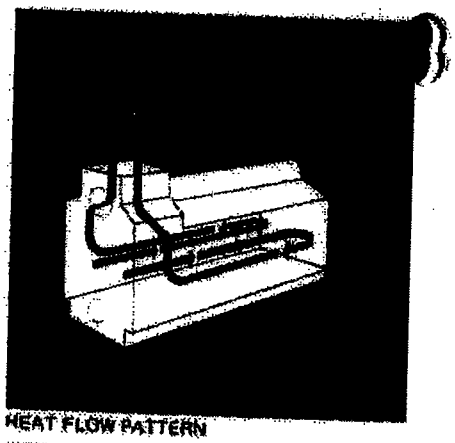
Air preheaters can also be mounted on top or off to the side according to plant requirements.



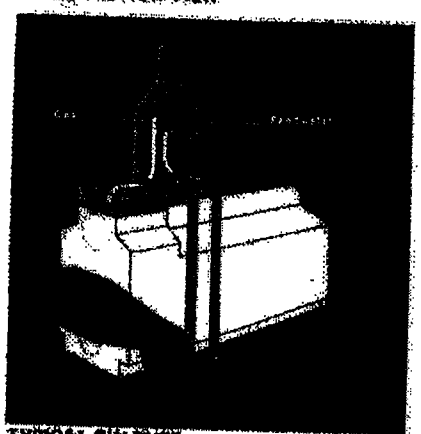
KEYSTONE PLAN VIEW



CROSS SECTION VIEW



HEAT FLOW PATTERN



TYPICAL FIN TUBE ECONOMIZER

TYPICAL REGENERATIVE AIR PREHEATER

1 Two-Drum Symmetrical Arrangement

All tubes terminate in the large drums with no intermediate headers. The generous steam-relieving surface of the full-length drum contribute to stable water level and high steam purity.

2 Burners

A full selection of Zurn fuel burning systems with the ability to burn a large variety of fuels enhances the unit responsibility.

3 Tangent Furnace Tube Walls

The furnace side walls are formed by tangent tubes which provide 100% water-cooled surface resulting in an extremely low heat absorption rate. Welding of the tubes is not required which facilitates furnace tube replacement.

4 Convection Tubes

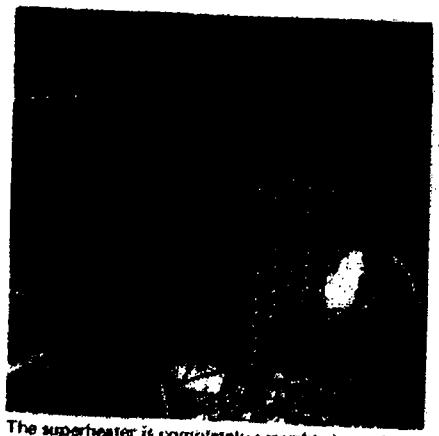
In-line convection zone tubes insure adequate flow area and flue gas contact with the heating surfaces to maximize heat transfer.

5 Water Wall Construction

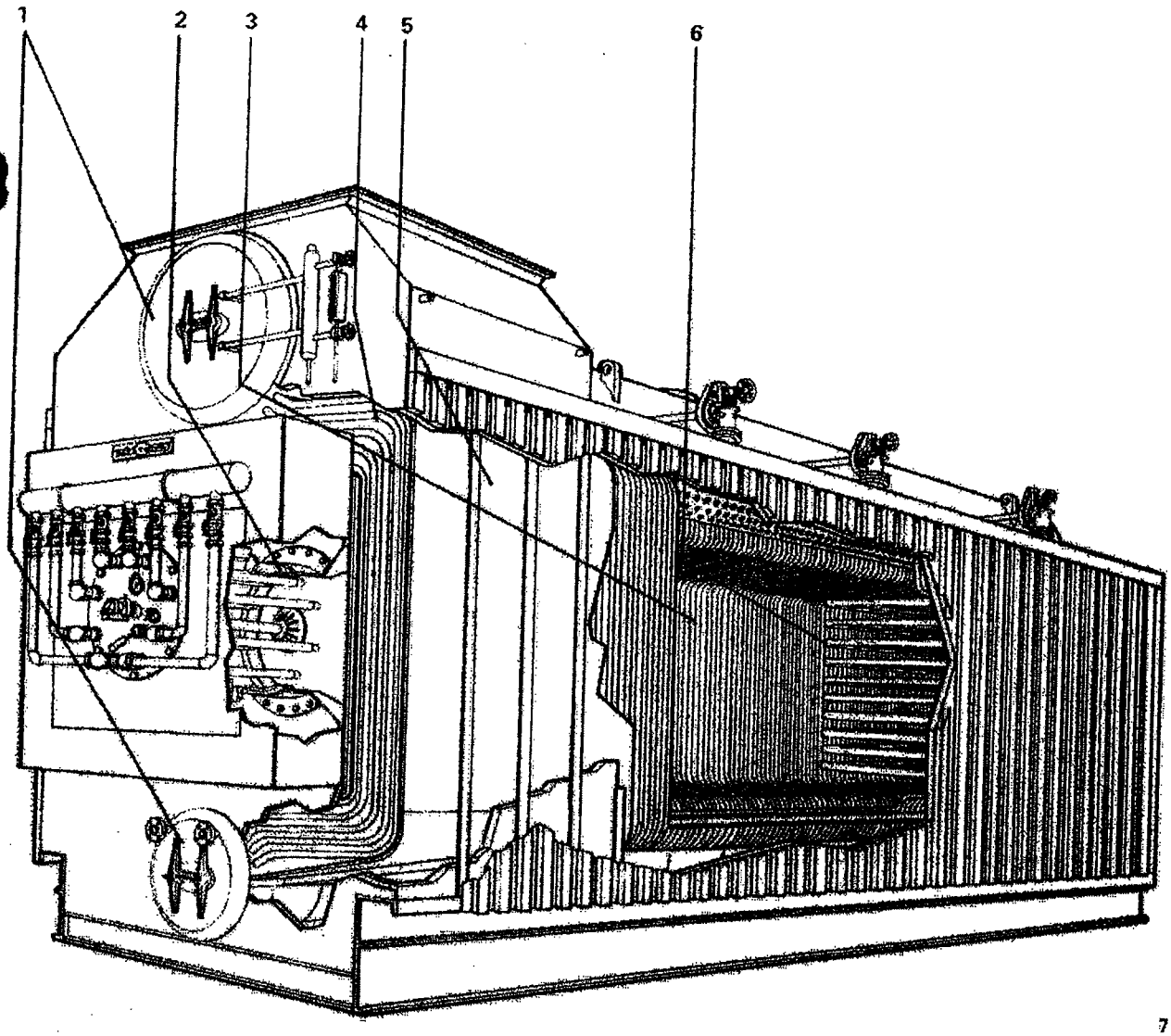
Tangent outside tubes with a reinforced welded inner seal casing provide a gas-tight envelope. Jacketed insulation is applied for minimum heat loss. An outer ribbed lagging adds final exterior protection.

6 Drainable Type Superheater

A separate superheater module is installed in the rear of the furnace. This arrangement is characteristic of a flat, total steam temperature curve throughout the normal operating range of the unit. Superheater headers are located outside of the flue gas area.



The superheater is completely assembled, welded, and stress relieved prior to installation through the KEYSTONE rear wall area. Alloy tubing and one (1) ppm steam purity insure exacting performance and long operating life to this very critical component of the steam generator.



KEYSTONE: WALL CONSTRUCTION

Zurn design, engineering and manufacturing advances offer a complete range of wall construction technology.

FURNACE WALLS

Side Walls

☐ Tangent tube construction (Figure A) is standard on all KEYSTONES.

Rear Wall

☐ Water-cooled Tube and Tile (Figure B) is standard on smaller capacity units.

☐ Water-cooled and Welded (Figure C) construction for additional heating surface and minimum refractory maintenance is utilized on high capacity units.

Front Wall

☐ Refractory construction is standard on smaller capacity units.

☐ Water-cooled and Welded Walls (Figure C) are a cost-saving option available for high-capacity units. Figure D shows how the burner throat is an integral part of the water-cooled front wall.

CONVECTION SIDE WALLS

☐ Tangent Tube Construction (Figure A) is standard on all KEYSTONES.

☐ Welded Wall construction (Figure C) is recommended only for special applications.

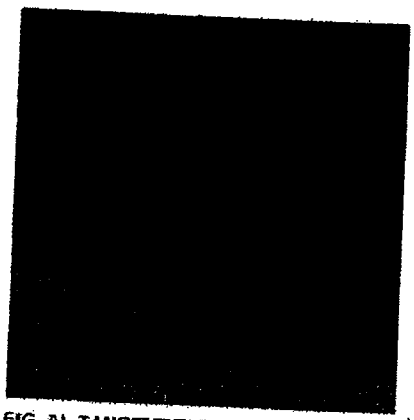


FIG. A) TANGENT TUBE CONSTRUCTION

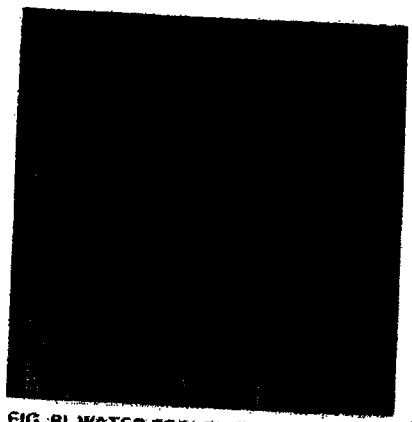


FIG. B) WATER-COOLED TUBE AND TILE

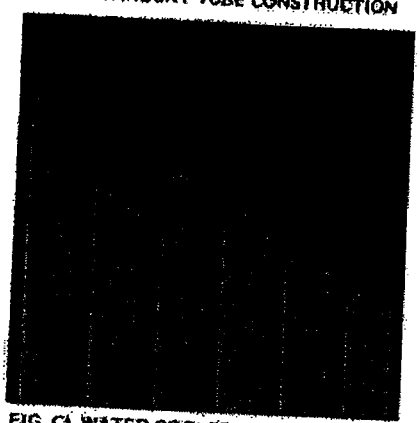


FIG. C) WATER-COOLED AND WELDED WALLS

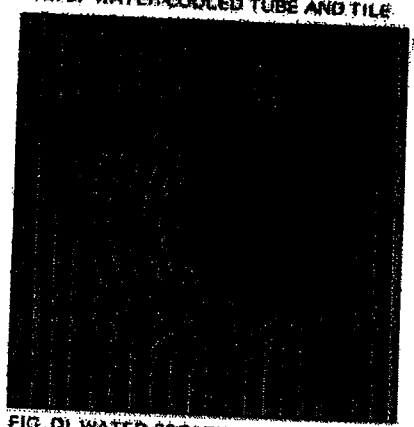
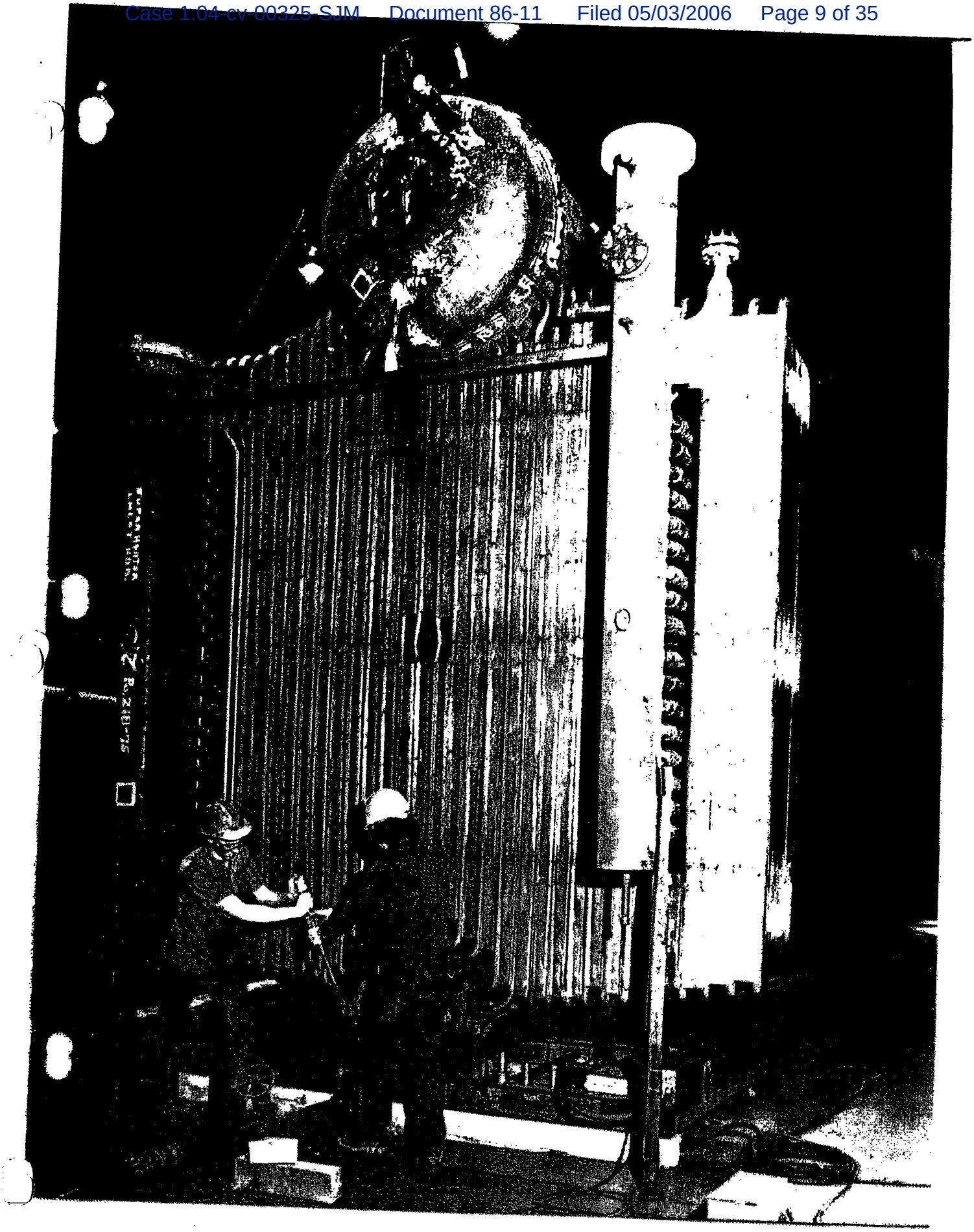
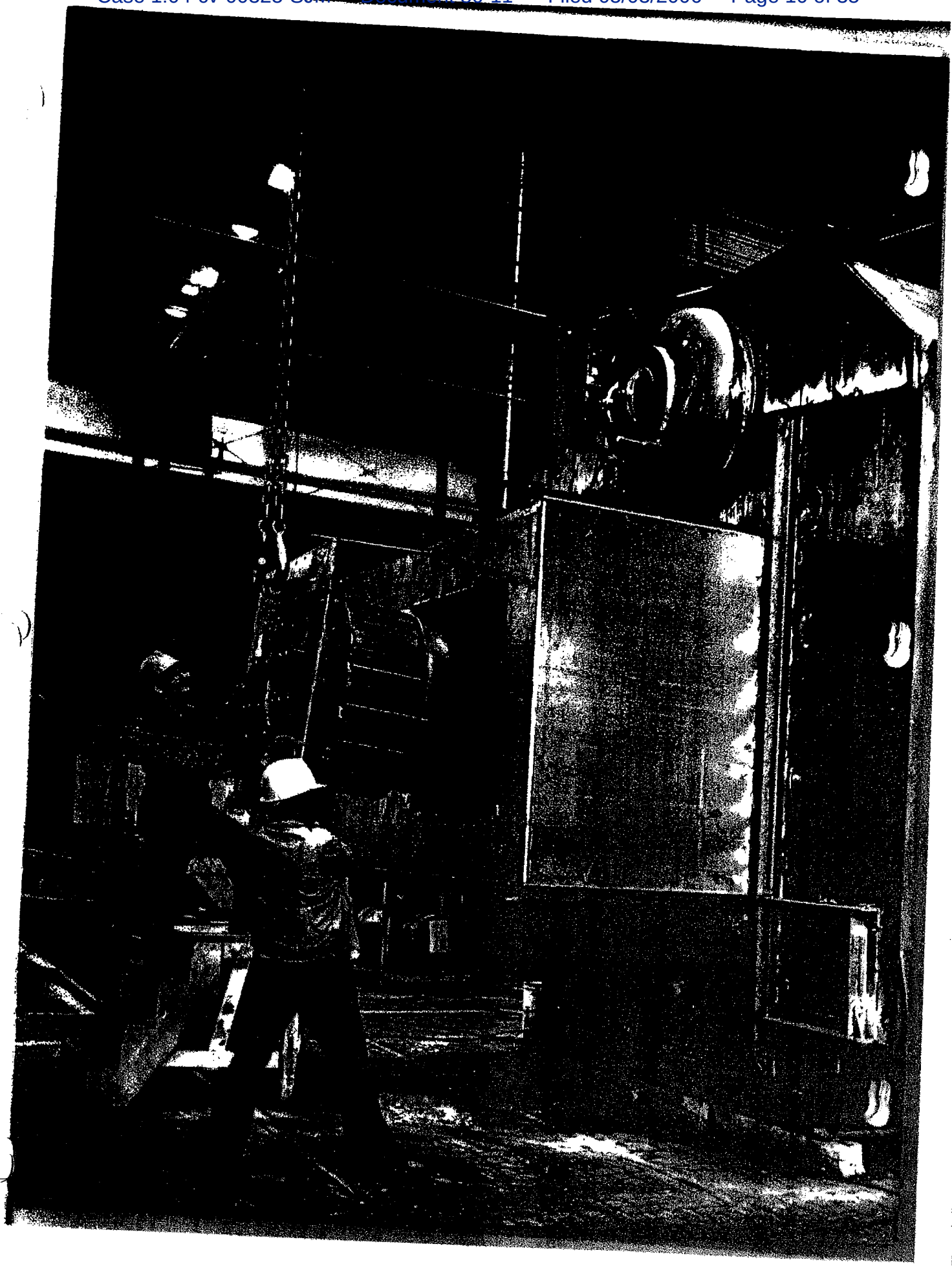


FIG. D) WATER-COOLED BURNER THROAT

right hand page
A Zurn KEYSTONE being constructed with a water-cooled and welded rear wall. This construction offers the ultimate in shop assembled steam generator design, increasing reliability and decreasing maintenance costs.

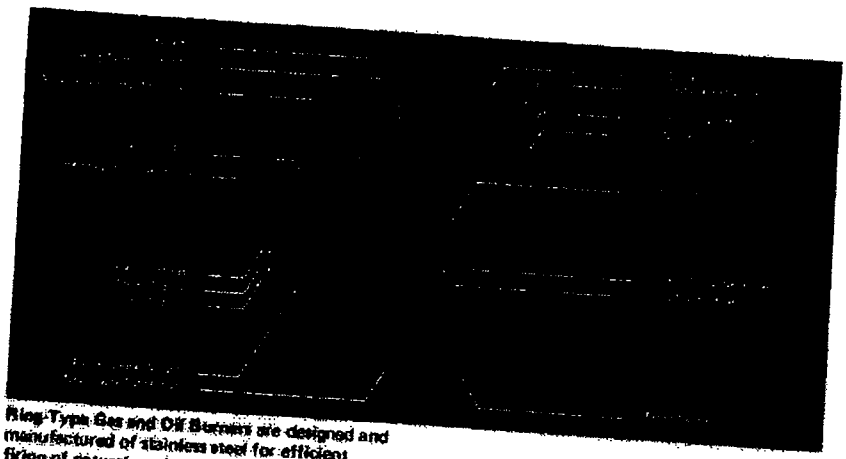




KEYSTONE: CUSTOM-DESIGNED FUEL BURNING SYSTEMS

Fuel Burning Equipment used with the KEYSTONE is pre-engineered and designed proportionately for the particular furnace to which it is applied. The flame pattern is projected down the furnace tunnel with an even distribution of heat input and uniform flow of combustion gases. The three T's of combustion – time, temperature, and turbulence – are taken into consideration to insure complete combustion and efficient operation.

The Zurn Energy Div. designs, manufactures, and installs its own burner on each steam generator as one generator-control-burner package. Also provided is a flame failure safety control system to suit all burner arrangements and to satisfy insurance code requirements. Combustion controls of the positioning or metering types, electrically or pneumatically-operated, are available.



Ring-Type Gas and Oil Burners are designed and manufactured of stainless steel for efficient firing of natural gas for the average capacity units. A steam-atomizing oil burner can be used by itself or in connection with a gas burner for burning all grades of fuel oil. Burner front is readily removable for easy access to the furnace area.

Multi-Jet Burners were developed to fire fuel gas in larger quantities. The design of the Multi-Jet Burner (shown combined with a Vortex Burner above) provides the best method of mixing fuel and air. The ability to clean the burner while the steam generator is on the line – without loss of steam production – is also a very desirable feature. Each jet is equipped with a shut-off valve allowing individual jet cleaning while in service.

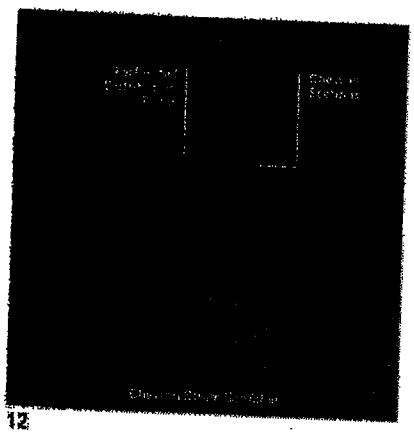
Vortex Burners are specially designed for low BTU waste fuels. This burner is adapted for firing CO gas, blast furnace gas or other low BTU fuels. The Vortex Burner has additional flexibility in that any ring-type or multi-jet burner is usually built into it for firing auxiliary fuels.

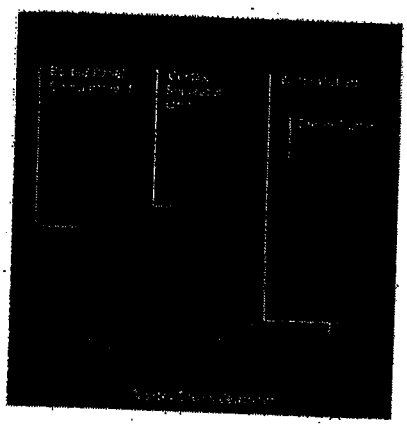
left hand page

A pre-assembled burner register is positioned into the windbox cavity followed by installation of the piping trains and control systems. Each steam generator/burner combination is designed and engineered for compatible performance and reliable, efficient operation for many years.

KEYSTONE: STEAM PURIFYING EXCELLENCE

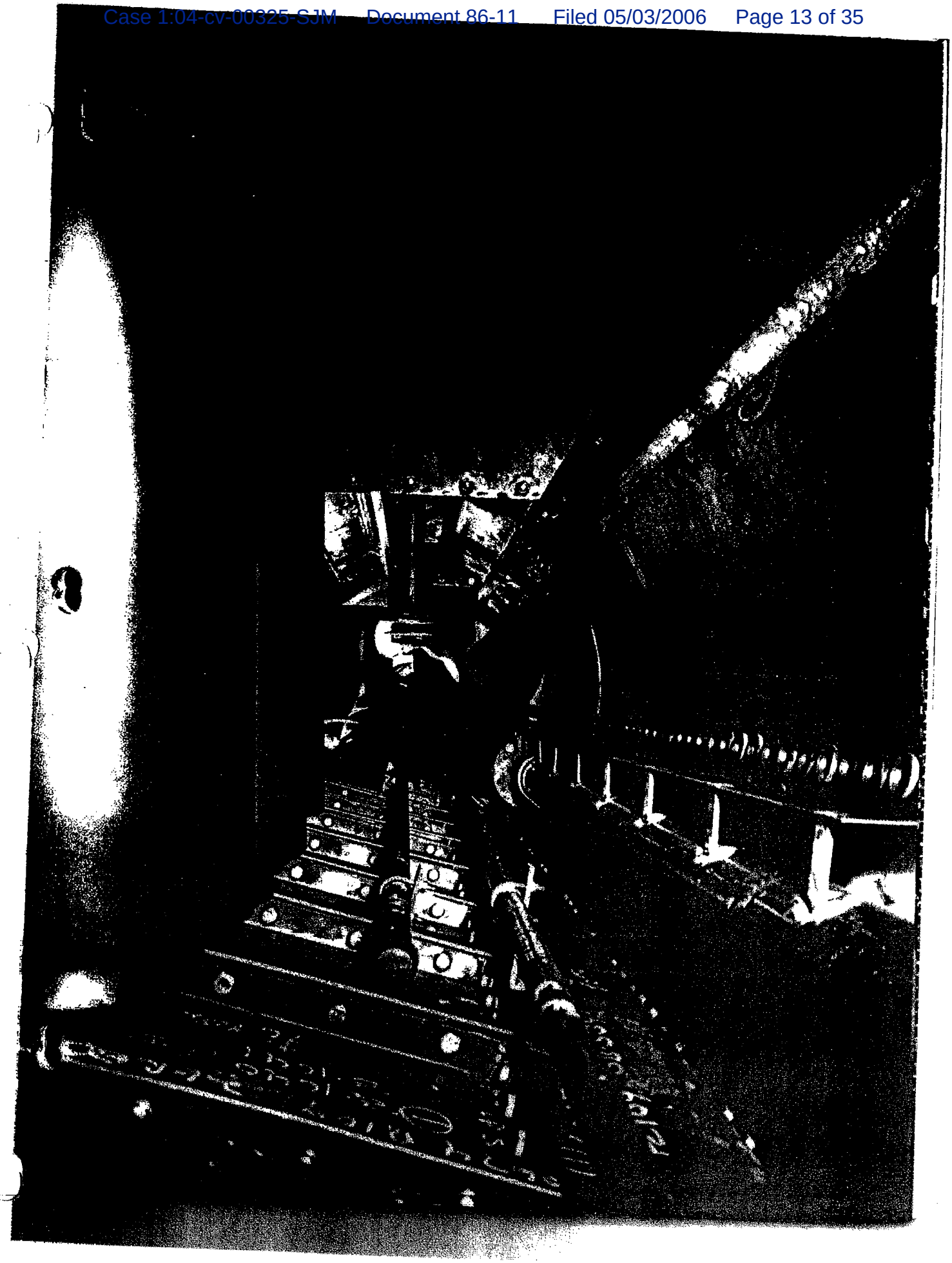
Unsurpassed steam purity is of prime importance. Each KEYSTONE is furnished with the type of drum internals for the particular application. Extreme care in design and manufacture provides uniform water level control and guards against moisture carry-over. Chevron Scrubbers combined with division plates are used when 3 ppm quality steam is required. Steam rises and flows through the scrubber where it is subjected to a continuous reversal of direction. Any remaining moisture clings to the metal scrubber plates and is trapped back to the generator water. Vortex Steam Separators are used in combination with Chevron Scrubbers when steam quality of 1 ppm or better is required. The steam and water mixture containing dissolved and suspended solids is subjected to intensive centrifugal action by the cylindrical vortex separator. Moisture and entrained solids are forced against the wall of the vortex and discharged downward. The end result is steam of excellent quality and high purity which meets and often surpasses exacting American Boiler Manufacturers Association (ABMA) recommendations.

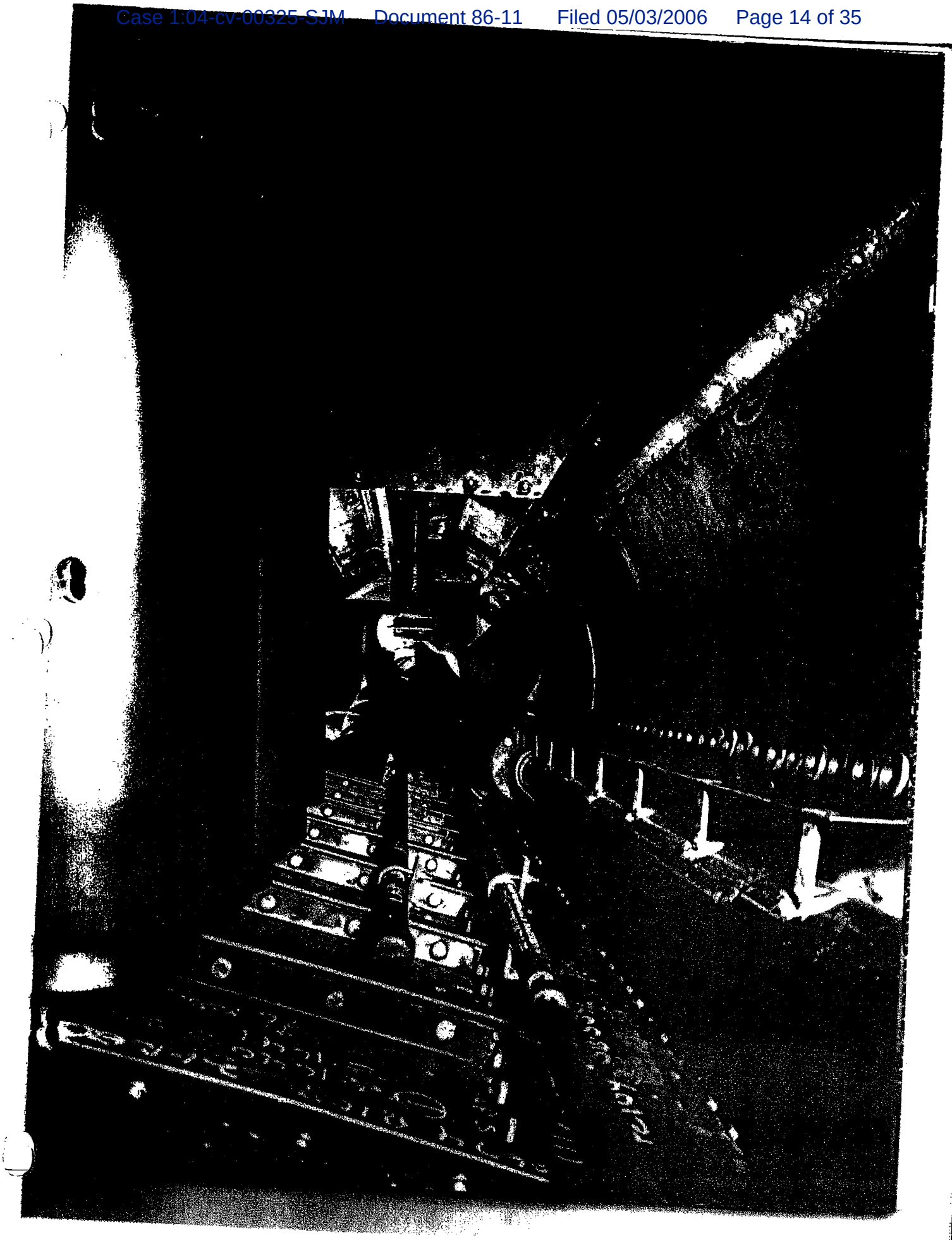




above
Vortex components are pre-assembled prior to installation in the steam drum.

right hand page
Steam purifying drum internals are carefully installed within the upper drum. The number, position, and component make-up of these steam purifying "cans" is carefully designed for the particular application.

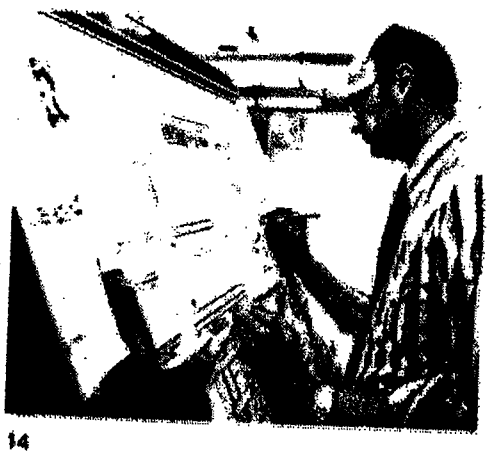




KEYSTONE: DESIGNED AND MANUFACTURED FOR DEPENDABLE SERVICE

Once a KEYSTONE is properly designed and detailed, each component is manufactured under a strict quality control program. Modern, specially-designed tools and equipment in the hands of qualified, experienced craftsmen produce a high quality product. Extensive work has been done in developing our Quality Assurance Manual which details step-by-step quality control at all levels -- material procurement, in-process checks at all stages, and final inspection. Mandatory check lists covering all operations check and double-check each operation. In addition to mandatory ASME, American Boiler Manufacturers Association and other code tests for pressure vessels, each unit receives air pressure tests on the inner casing and a complete electrical check-out.

Initial comprehensive and detailed engineering design assures an integrated package from varying components. Preliminary analysis is conducted, utilizing computer technology to properly select and calculate design performance, and specify each component so that every requirement is presented with an integrated system at the best possible economy. All input data is carefully analyzed and designs are altered if necessary.



above
Uniform construction is assured with a step-by-step quality control program.

far left
Detailed engineering design is an important preliminary element for assuring an integrated package from varying components. A Project Manager is assigned to each contract to not only review initial engineering specifications but also to coordinate the many phases of total job responsibility.

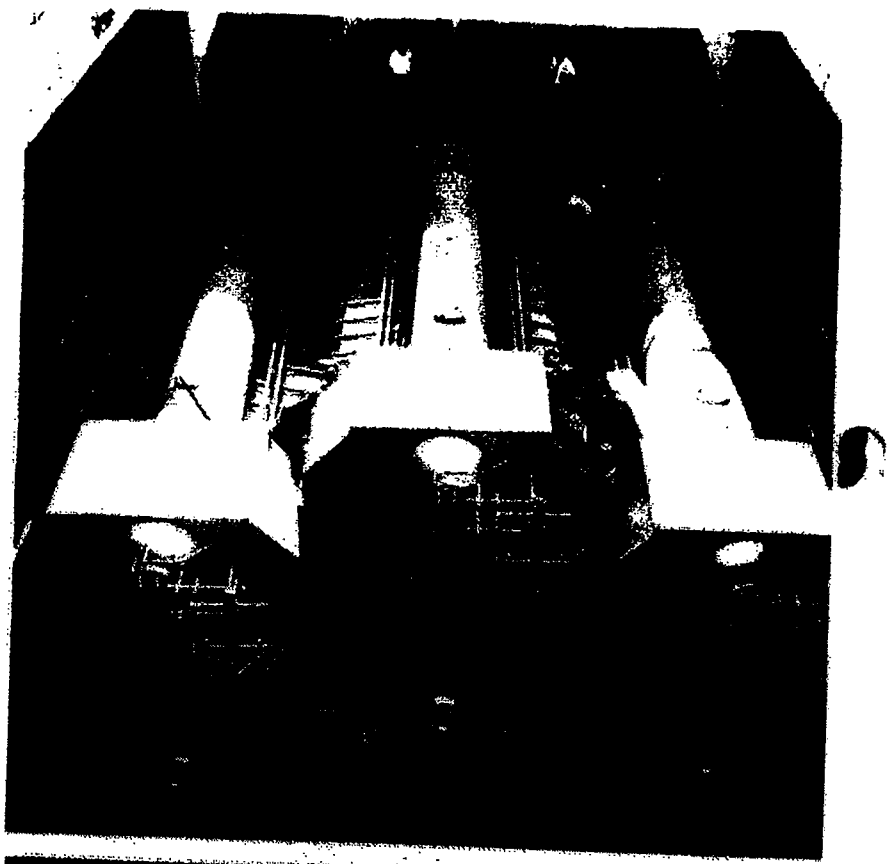
near left
Proper selection and performance is assured at the very beginning by extensive use of computer analysis.

right hand page
Overall view of fabrication and assembly area for KEYSTONE Steam Generators.

KEYSTONE: DELIVERED AS A PACKAGE

The symmetrical design and balance of every KEYSTONE insures easy handling and installation. The KEYSTONE can be skidded, jacked, or rigged without the use of special counterweights or slings. An ordinary concrete slab is all that is required to support the base. After the necessary fuel, water, and electrical connections are made the KEYSTONE is ready to operate.

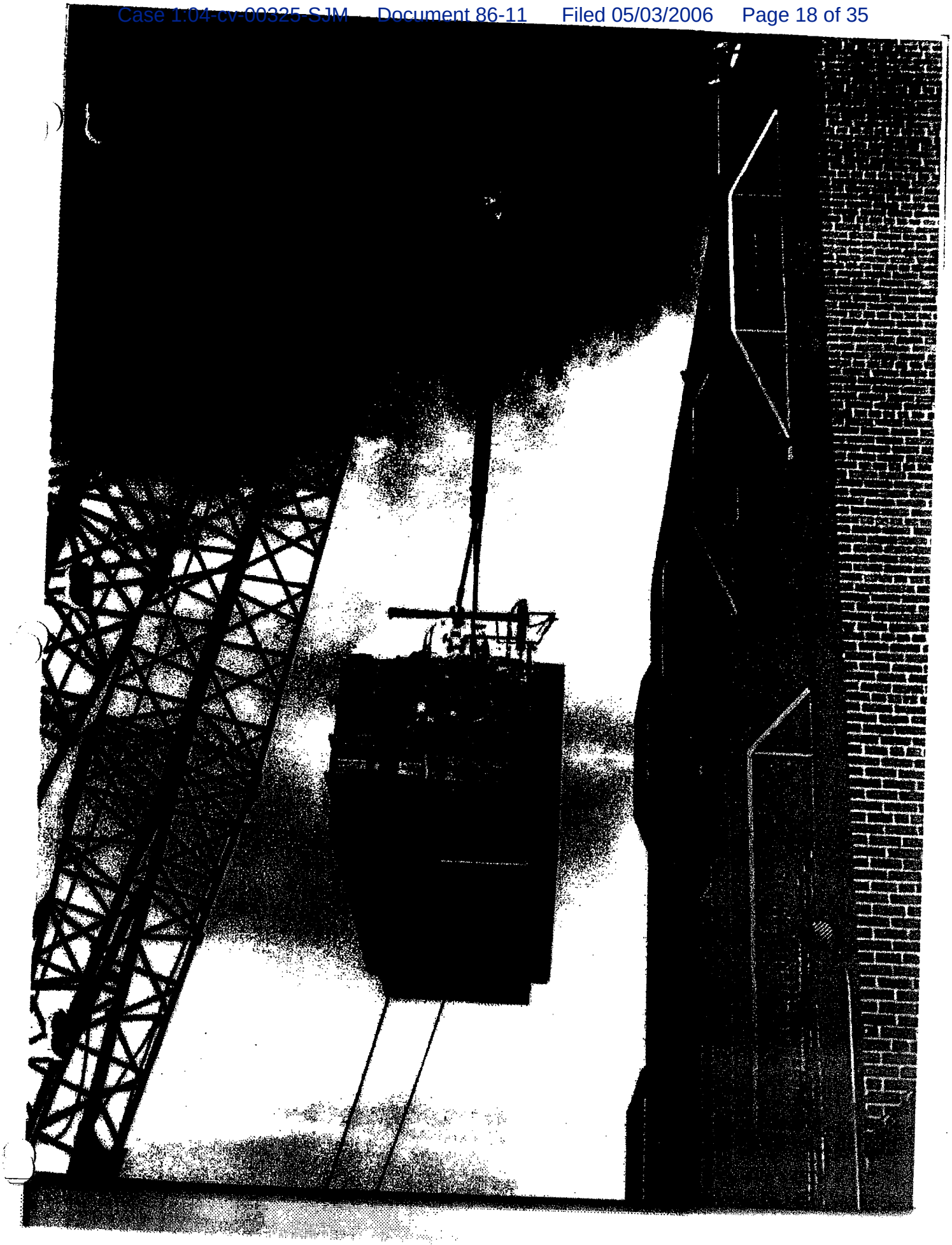
The overall physical dimensions of large factory-assembled KEYSTONE steam generators are determined by transportation clearances. Factory-assembled units can be shipped via standard rail car, low-boy truck, ship or barge, or our own specially-designed depressed-bed railroad flat car. Direct access to the Port of Erie, Pennsylvania opens up shipping channels over the vast area covered by the Great Lakes/St. Lawrence Seaway and their inter-connecting canal and river outlets. When it becomes necessary to field-erect a unit, every effort is made to transport pre-fabricated sections that can be "packaged" on-site to minimize field expense.

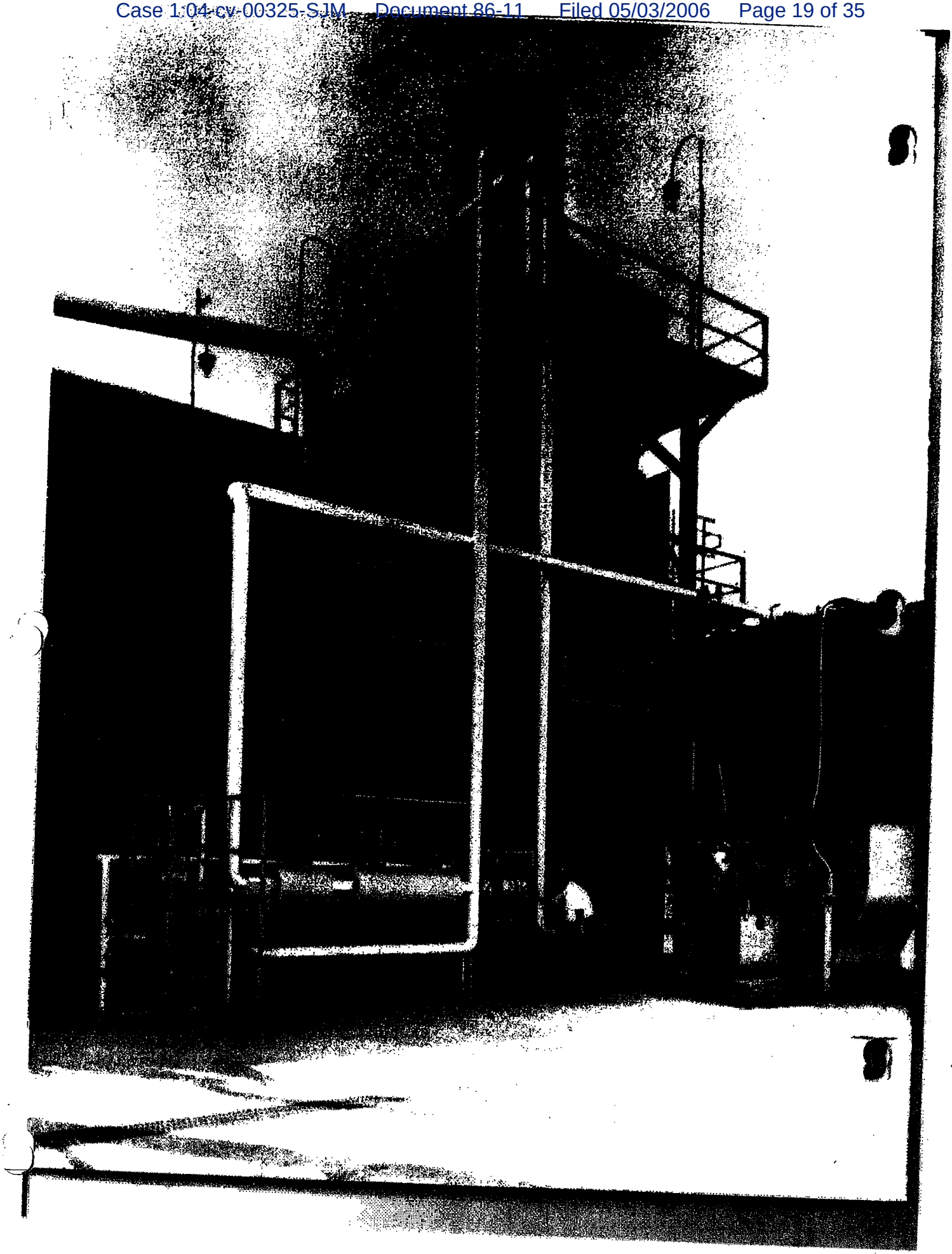


top right
The compact design of the KEYSTONE not only aids in installation, but also in shipping, as demonstrated by this KEYSTONE being tightly "nestled" into the hold of a ship, ocean-bound via the Great Lakes/St. Lawrence Seaway.

bottom right
Sometimes it is advantageous to ship via long stretches of unobstructed waterways easily accessible through the Port of Erie.

right hand page
KEYSTONES are often the first system to be installed while new buildings are being constructed. Note the symmetrical balance of this 200,000 pounds-of-steam-per-hour steam generator being hoisted into final position.

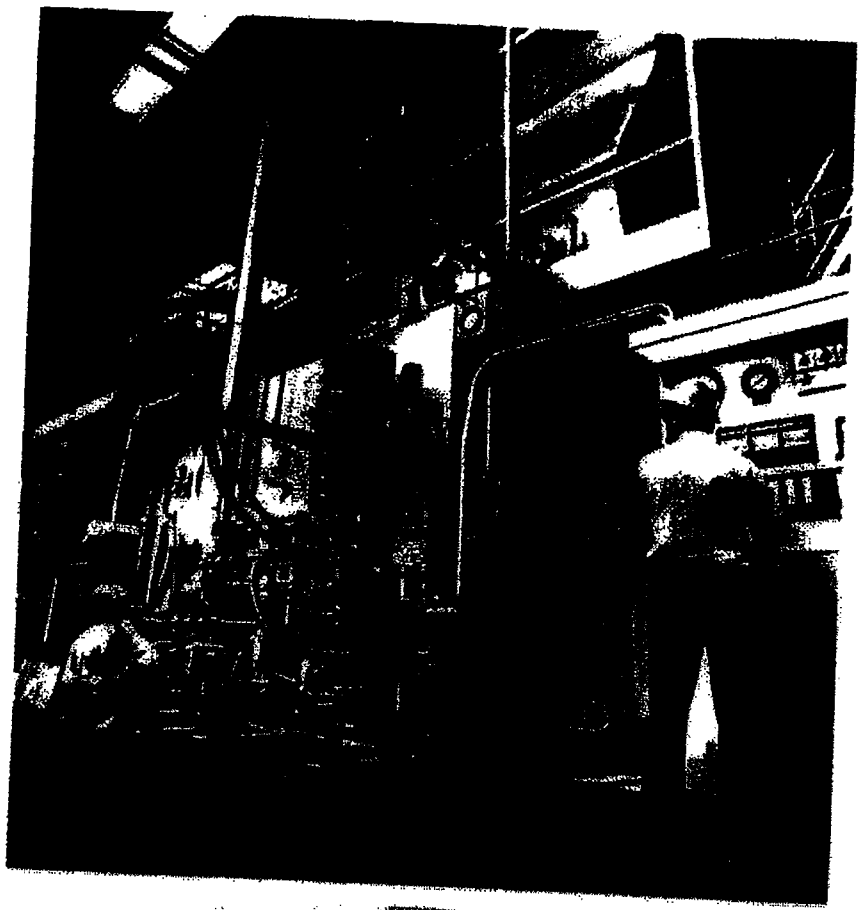




KEYSTONE: IN WORLD-WIDE SERVICE

Zurn Industries, Inc., Energy Div. employs a large, experienced service organization which can help you in all your field service requirements. Skilled service engineers can supervise installation, start-up the unit and adjust it for optimum performance. They will instruct your operators on proper operation and maintenance of the unit for a long, trouble-free life. If due to an emergency you should ever need service at a moment's notice, necessary men and equipment will be rushed to your site to make certain the unit will be back on line with a minimum of downtime.

The increasing international market for this product has resulted in not only increased exports but also the establishment of licensing agreements for manufacture of the KEYSTONE throughout the world.



right
A typical interior installation of a "packaged" KEYSTONE provides useful steam energy for heating and process systems at a major distillery. This 70,000 pounds-of-steam per-hour KEYSTONE, rated at 200 PSIG, burns natural gas and No. 2 fuel oil and is equipped with a fin tube economizer designed and manufactured by Zurn Heat Transfer Div. as well as a Zurn Air Systems Div. forced draft fan.

lower right
A battery of four field-erected KEYSTONES, installed over a period of several years to meet increasing demands of phased expansion of a petrochemical complex, provides 1,000,000 pounds-of-steam per-hour (250,000 each) at 650 PSIG.

Such KEYSTONES are field-erected when overall physical dimensions are greater than transportation allowances. Pre-fabricated sections are shipped so that the unit can be "packaged" on site with a minimum of field-erection time. Economical to install, operate, and maintain, the field-erected KEYSTONE can provide up to 500,000 pounds-of-steam per-hour.

left-hand page
A field-erected KEYSTONE, in operation five years for a chemical plant, provides 250,000 pounds-of-steam per-hour at 300 PSIG and is equipped with a superheater and fin tube economizer.

KEYSTONE: COMPREHENSIVE PRODUCT SALES AND SUPPORT

Zurn Industries, Inc., Energy Div. maintains a comprehensive network of conveniently-located sales and service facilities in major U.S. cities to completely surround you with marketing expertise. Whatever your steam generating requirements — from specification to start-up and beyond — an experienced sales or service engineer is only minutes away to serve your every need. They're experienced in a wide range of industrial, power, utility and process applications and they know the KEYSTONE inside and out. Every effort is made to provide the right integrated package for each specific application. To assure the ultimate in customer satisfaction, the Zurn Energy Div. enables them to offer a wide selection of specification choices — fuel burning systems, economizers, air heaters, superheaters, heat recovery systems, steam purifying systems, flame safety control systems and pollution control systems — each designed and engineered to assure maximum efficiency, economy and reliability of the overall system.

Sales and Service Offices
Amarillo, Texas
Atlanta, Georgia
Boston, Massachusetts
Chicago, Illinois
Cincinnati, Ohio
Cleveland, Ohio
Dallas, Texas
Denver, Colorado
Detroit, Michigan
Houston, Texas
Kansas City, Missouri
Little Rock, Arkansas
Los Angeles, California
Lubbock, Texas
Memphis, Tennessee
Minneapolis, Minnesota
New Orleans, Louisiana
New York, New York
Philadelphia, Pennsylvania
Pittsburgh, Pennsylvania
Portland, Oregon
Raleigh, North Carolina
St. Louis, Missouri
Salt Lake City, Utah
San Francisco, California
Shreveport, Louisiana
Tampa, Florida
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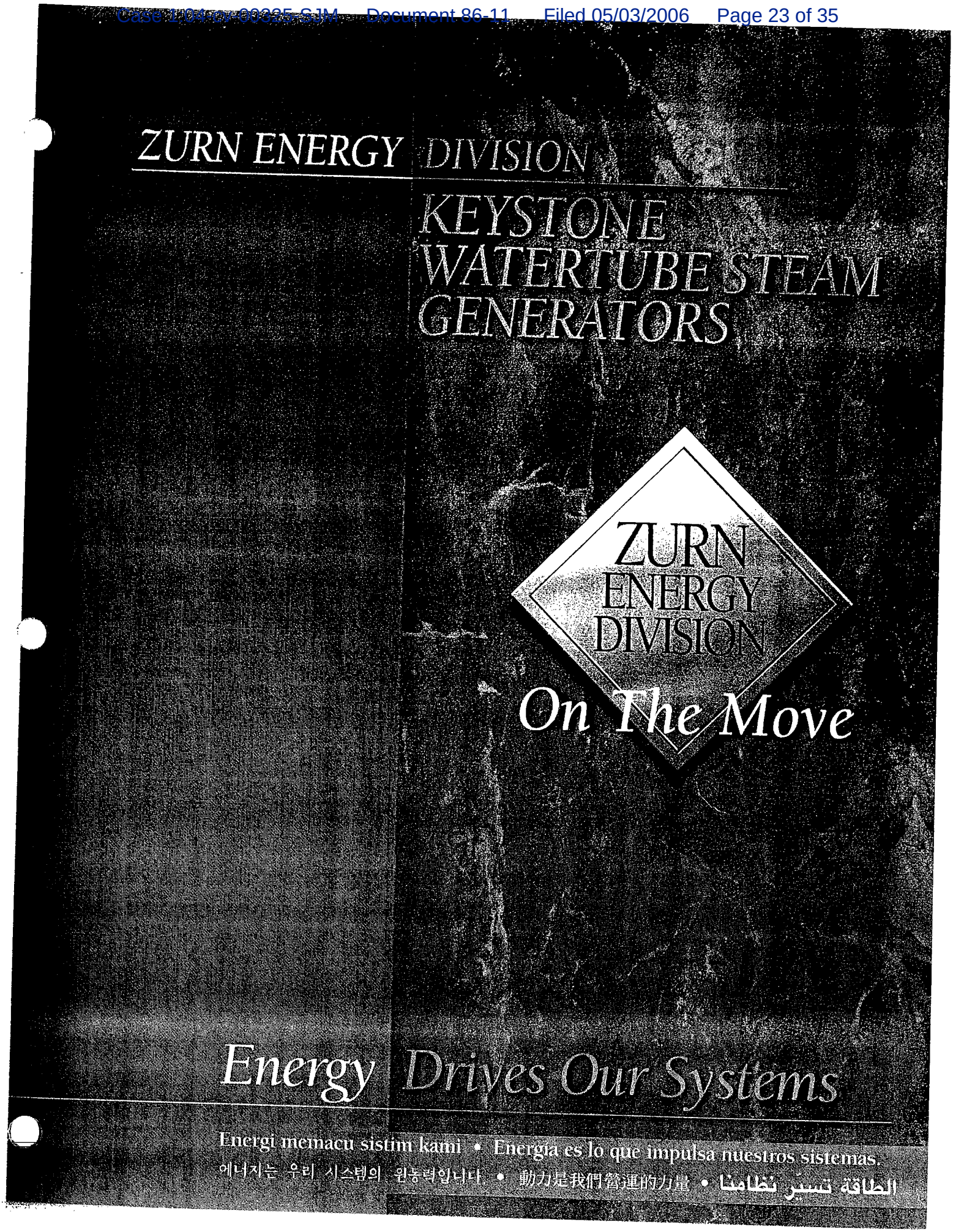
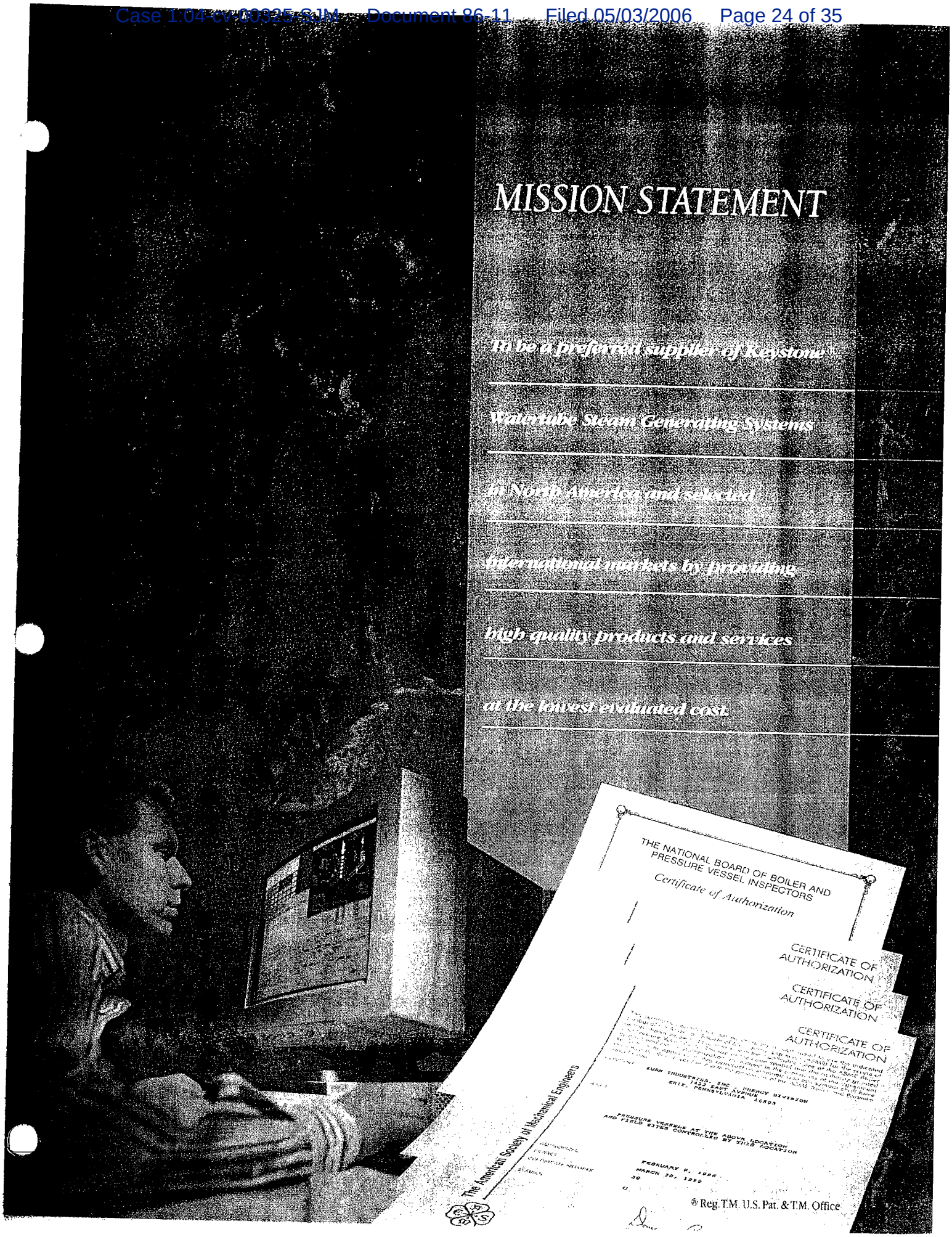
ZURN INDUSTRIES, INC.
ENERGY DIV.
1422 EAST AVE.
ERIE, PA. U.S.A. 16503
PHONE: 814/452-8421
TELEX: 91-4473

Form No. SB-71, 11/80


ZURN ENERGY DIVISION
KEYSTONE
WATERTUBE STEAM
GENERATORS
ZURN
ENERGY
DIVISION
On The Move
Energy Drives Our Systems
Energi memacu sistim kami • Energía es lo que impulsa nuestros sistemas.
에너지는 우리 시스템의 원동력입니다 • 動力是我們營運的力量 • الطاقة تسيّر نظامنا


MISSION STATEMENT
To be a preferred supplier of Keystone
Watertube Steam Generating Systems
in North America and selected
international markets by providing
high quality products and services
at the lowest evaluated cost.
THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS
Certificate of Authorization
CERTIFICATE OF AUTHORIZATION
CERTIFICATE OF AUTHORIZATION
CERTIFICATE OF AUTHORIZATION
The American Society of Mechanical Engineers
® Reg. T.M. U.S. Pat. & T.M. Office

FULL SERVICE CAPABILITIES FOR WATERTUBE STEAM GENERATOR NEEDS

ISO 9001

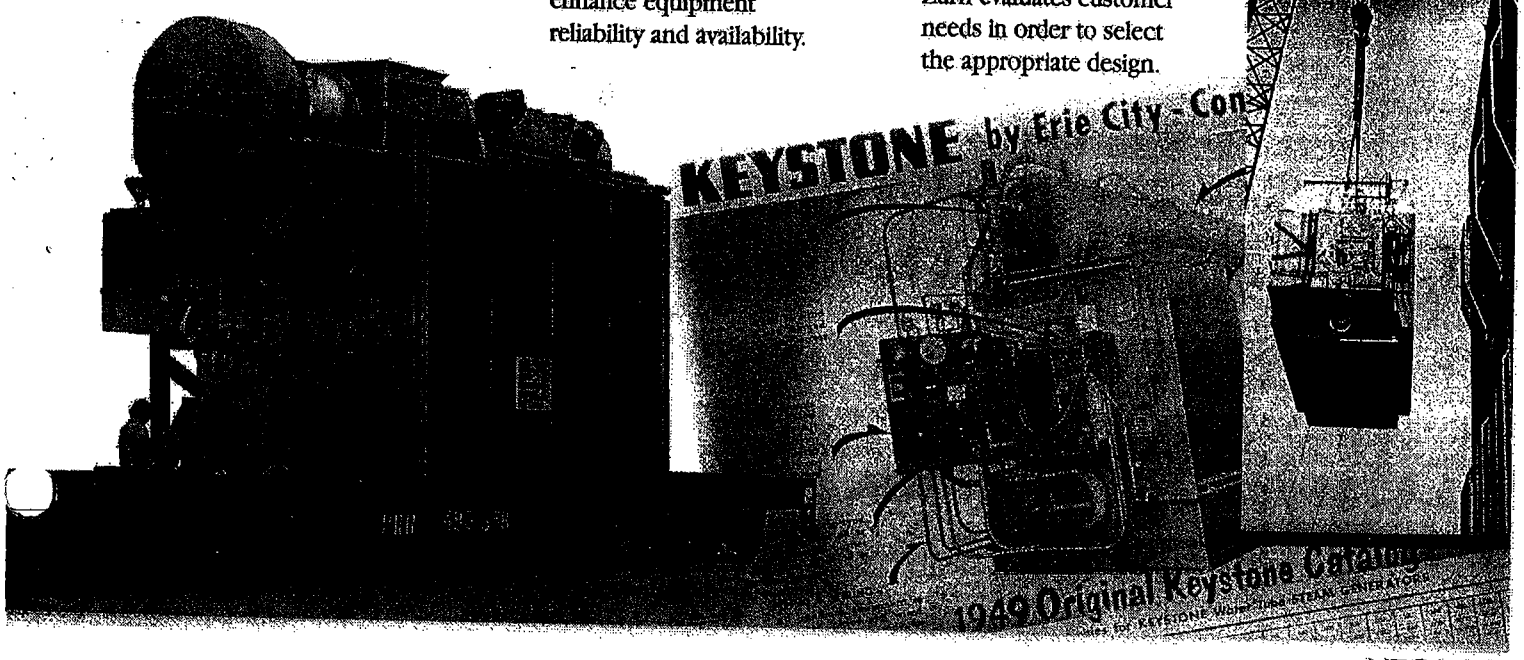
With over 3,000 Keystone® watertube steam generators in service worldwide for commercial and industrial steam generation applications, the Zurn Energy Division is recognized as one of the leading suppliers of watertube steam generators. Zurn is meeting the challenges of today's competitive environment in productivity and quality as well as offering innovative designs for our customers' steam generation needs. When selecting the Zurn Energy Division as your preferred supplier of watertube steam generators, you will receive the following benefits:

- **Experience and Expertise**
  With 155 years of experience in the boiler industry, Zurn engineers draw upon their vast experience to continuously enhance watertube steam generator design.
- **Quality**
  The Zurn Energy Division is dedicated to continuous improvement and is an ISO 9001 certified company. The Zurn Energy Division currently holds the oldest active ASME stamp issued for boiler fabrication.
- **Customer Service/ Aftermarket**
  The Zurn Energy Division provides prompt service and replacement parts to enhance equipment reliability and availability.
- **Global Outsourcing**
  The Zurn Energy Division has flexible response capabilities which utilize domestic and international fabrication partners and strategic business alliances to provide customers with the lowest evaluated costs.
- **Fuel Flexibility**
  The Keystone watertube steam generator is capable of burning standard natural gases and oils along with special fuels like carbon monoxide, landfill gas, fume incineration, pitch, waste liquids and waste gases.
- **Design Flexibility**
  The Keystone watertube steam generator is available in either an "O" or a "D" type boiler configuration. Zurn evaluates customer needs in order to select the appropriate design.

Below, left to right:
A shop-assembled 70,000 lbs/hr (31.75 tons/hr) Keystone ready for rail shipment.

A 1949 original Keystone brochure used by Erie City Iron Works, which became the Zurn Energy Division in 1966.

A shop-assembled Keystone being lifted into an existing building. Special lifting requirements are not needed with the symmetrical "O" design.



VEO9271

KEYSTONE® WATERTUBE STEAM GENERATORS — "O" SERIES

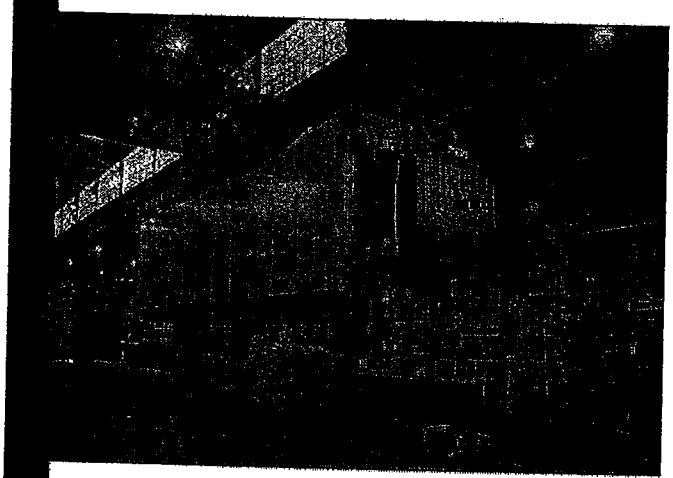
The Keystone "O" Series watertube steam generator has been designed with the flexibility to meet unique project requirements.

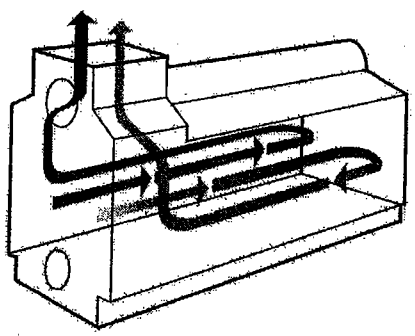
CAPACITY RANGE

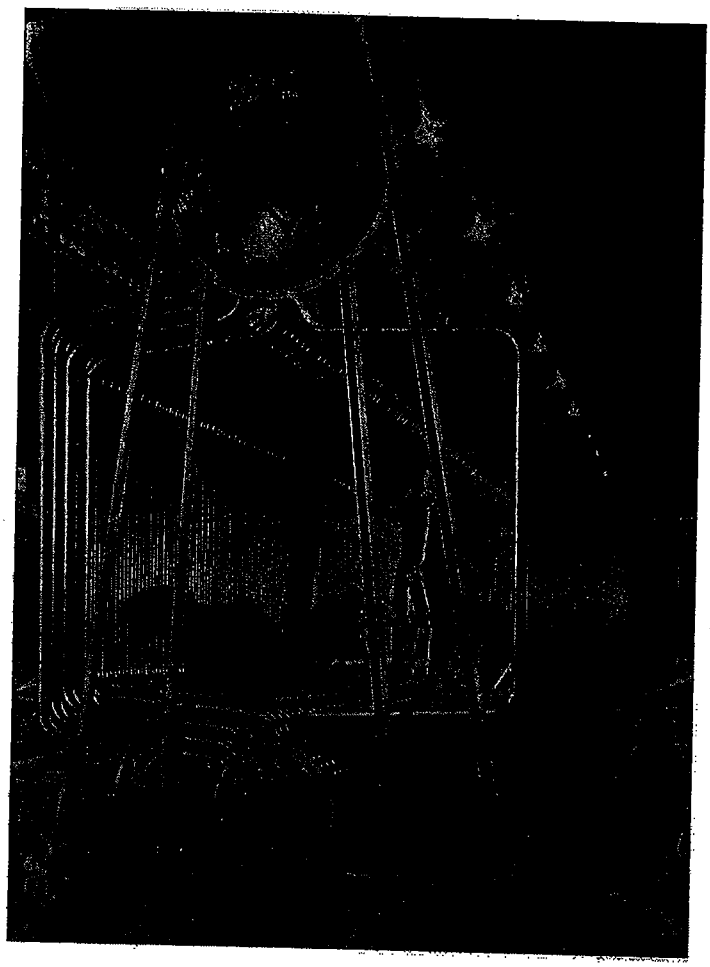
The Keystone "O" Series watertube steam generator is capable of producing steam up to 500,000 lbs/hr (227 tons/hr) at design pressures up to 2,000 PSIG (138 bar) and superheated steam up to 1,000°F (538°C) for both shop-assembled and field-erected designs.

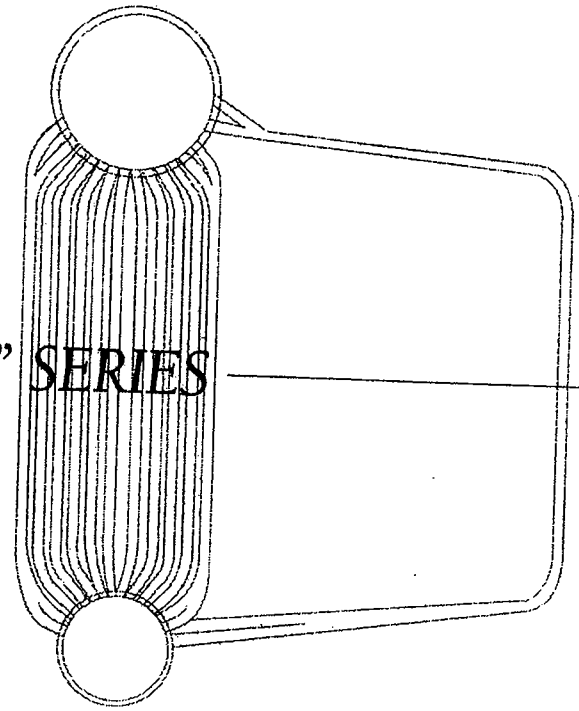
FEATURES AND BENEFITS

- High service factors for severe duty applications.
- High steam pressure and temperature applications.
- Adaptability to unique fuels.
- Quick ramping capabilities throughout the load range.
- Flat superheater curve over the load range.
- Symmetrical design which allows for ease in transportation, lifting and foundation design; special rigging is not required.









"D" SERIES

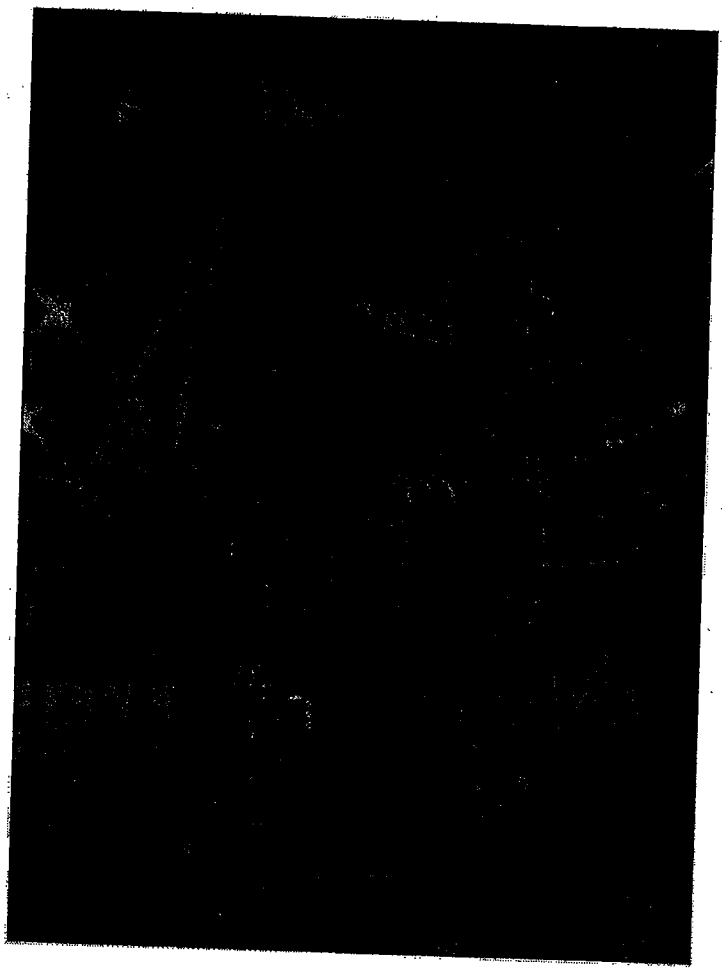
The Keystone "D" Series watertube steam generator has been designed to reduce overall project cycle time and to lower steam generating equipment costs for our customers.

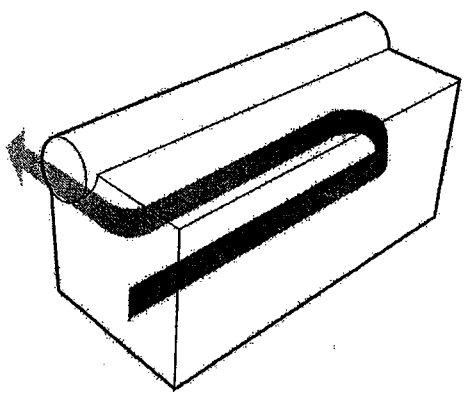
CAPACITY RANGE

The Keystone "D" Series watertube steam generators are capable of producing steam in excess of 150,000 lbs/hr (68 tons/ hr) at design pressures up to 825 PSIG (56.9 bar) and saturated or superheated steam up to 750°F (399°C).

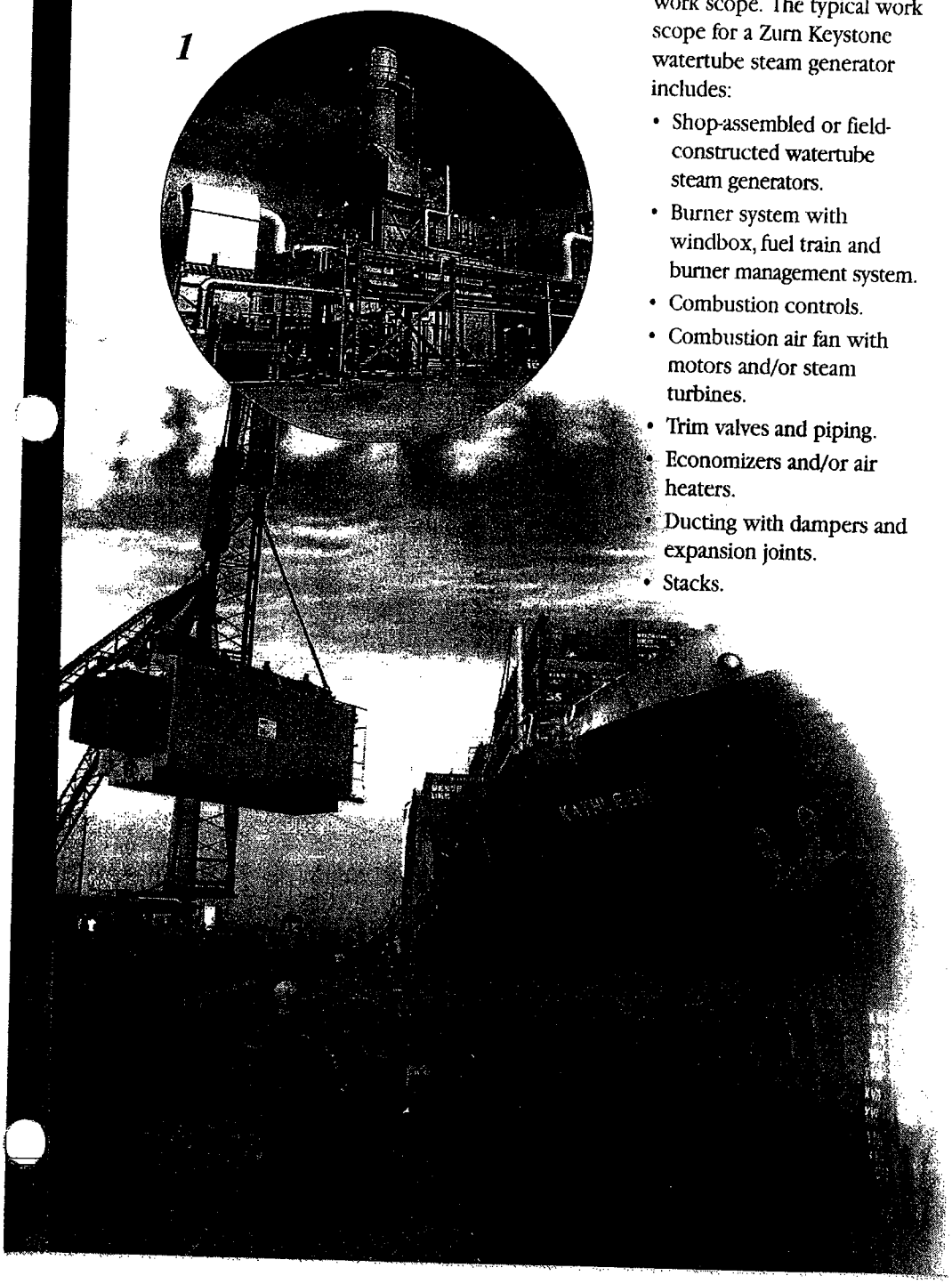
FEATURES AND BENEFITS

- Faster cycle time.
- Reduced equipment cost.
- Pre-engineered models.





KEYSTONE® INSTALLATIONS BY ZURN ENERGY DIVISION



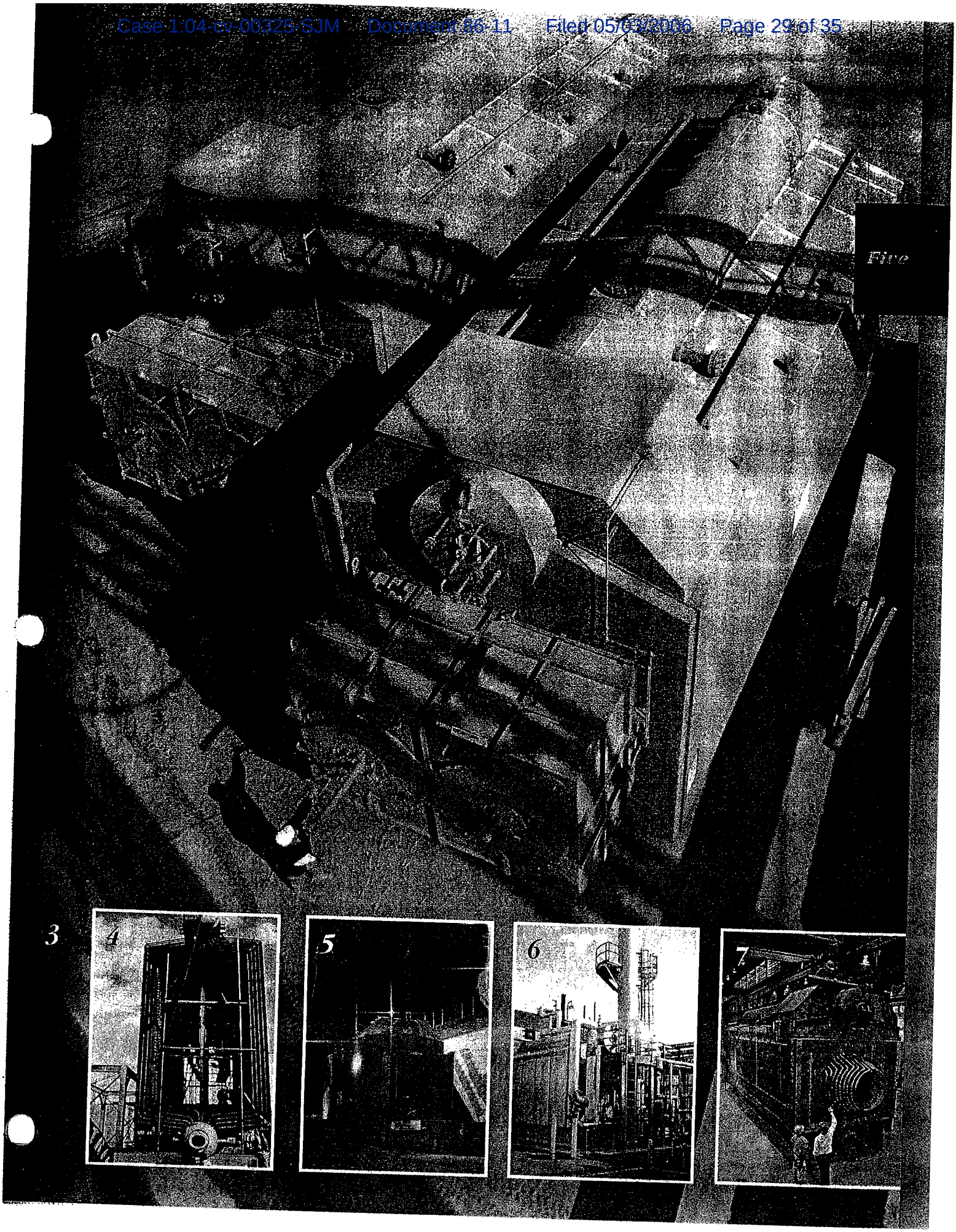
Zurn Keystone® installations can include a wide variety of work scope. The typical work scope for a Zurn Keystone watertube steam generator includes:

- Shop-assembled or field-constructed watertube steam generators.
- Burner system with windbox, fuel train and burner management system.
- Combustion controls.
- Combustion air fan with motors and/or steam turbines.
- Trim valves and piping.
- Economizers and/or air heaters.
- Ducting with dampers and expansion joints.
- Stacks.

Zurn can also furnish the following optional components when required:

- SCR and FGR systems
- Feedwater pumps
- Chemical feed systems
- Deaerator and storage tanks
- Blowdown tanks
- Heat exchangers
- Erection
- Erection and start-up supervision
- Training

1. *An installed shop-assembled 250,000 lbs/hr (113.4 tons/hr) Zurn Keystone.*
2. *A shop-assembled 115,000 lbs/hr (52.2 tons/hr) Zurn Keystone being loaded onto an ocean vessel bound for Brazil.*
3. *Two of four shop-assembled 250,000 lbs/hr (113.4 tons/hr) Zurn Keystones to be located on an oil drilling platform in the Gulf of Mexico.*
4. *A field-assembled 275,000 lbs/hr (124.7 tons/hr) Zurn Keystone.*
5. *A shop-assembled 250,000 lbs/hr (113.4 tons/hr) Zurn Keystone designed to fire waste fuels being loaded onto an ocean vessel for Belgium.*
6. *An installed shop-assembled 230,000 lbs/hr (104.3 tons/hr) Zurn Keystone.*
7. *A Zurn Keystone featuring a water-cooled burner throat.*


Fire
3
4
5
6
7

ZURN ENERGY DIVISION PRODUCTS and SERVICES

Zurn HRSG uses heat from an 80 MW combustion turbine at this New Jersey cogeneration plant.

Zurn wood, tire and landfill gas fired boiler in operation in Polk County, Florida.

ZURN HEAT RECOVERY STEAM GENERATORS

Zurn Heat Recovery Steam Generators (HRSGs) are custom designed to meet the needs of both domestic and international cogeneration users while offering improved and innovative boiler designs, enhanced reliability and competitive pricing.

Zurn HRSGs are available for combustion turbines from 10 MW to the advanced utility type combustion turbines of over 250 MW generating capacity. Designs include natural circulation and assisted circulation modes with single or multiple pressure level applications including reheat and non-reheat applications.

ZURN SOLID FUEL-FIRED WATERTUBE STEAM GENERATORS

Zurn Solid Fuel-Fired Watertube Steam Generators are available in steam capacities ranging from 20,000 to over 600,000 lbs/hr (9 to 272 tons/hr), steam temperatures from saturated to over 1,000°F (538°C), and steam pressures from 100 to 2,000 PSIG (6.9 to 138 bar).

Zurn boilers are produced in a variety of factory-assembled, modular factory-assembled, and field-constructed designs. These designs incorporate various furnace wall designs, convection-bank flow patterns and heat recovery components such as preheaters and economizers.

ZURN CUSTOMER SERVICE-AFTER-MARKET

Zurn Customer Service is committed to understanding our customers' needs and then providing solutions, services, and equipment to meet their requirements.

This commitment is exemplified in the way of:

- Expedient, dependable, and expert after-market service.
- Fully stocked Zurn Service Center with replacement parts available 24 hours a day.
- Competitively priced replacement pressure parts, structural components and stoker components.
- Selected replacement components are also available for non-Zurn boilers.
- Design upgrades and enhancements of boiler pressure components, combustion equipment and structural components.
- Low NOx burner retrofits and upgrades.

ZURN / ENERGY DIV.

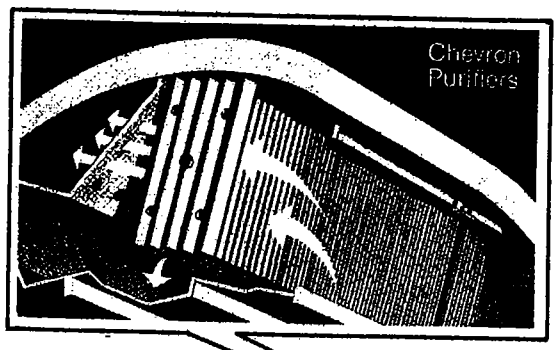
ZURN INDUSTRIES, INC.
ENERGY DIV.
1422 EAST AVE.
ERIE, PA. U.S.A. 16503-1592
TELEPHONE: 814/452-6421
FAX: 814/870-7188
E-MAIL: zedemail@zurnenergy.com

ZURN INDUSTRIES, INC.
ASIA-PACIFIC OPERATIONS
#21-12 TONG ENG BUILDING
101 CECIL STREET
SINGAPORE 069533
TELEPHONE: 65-225-4922
FAX: 65-225-4923

Form No. SB-71 11/96

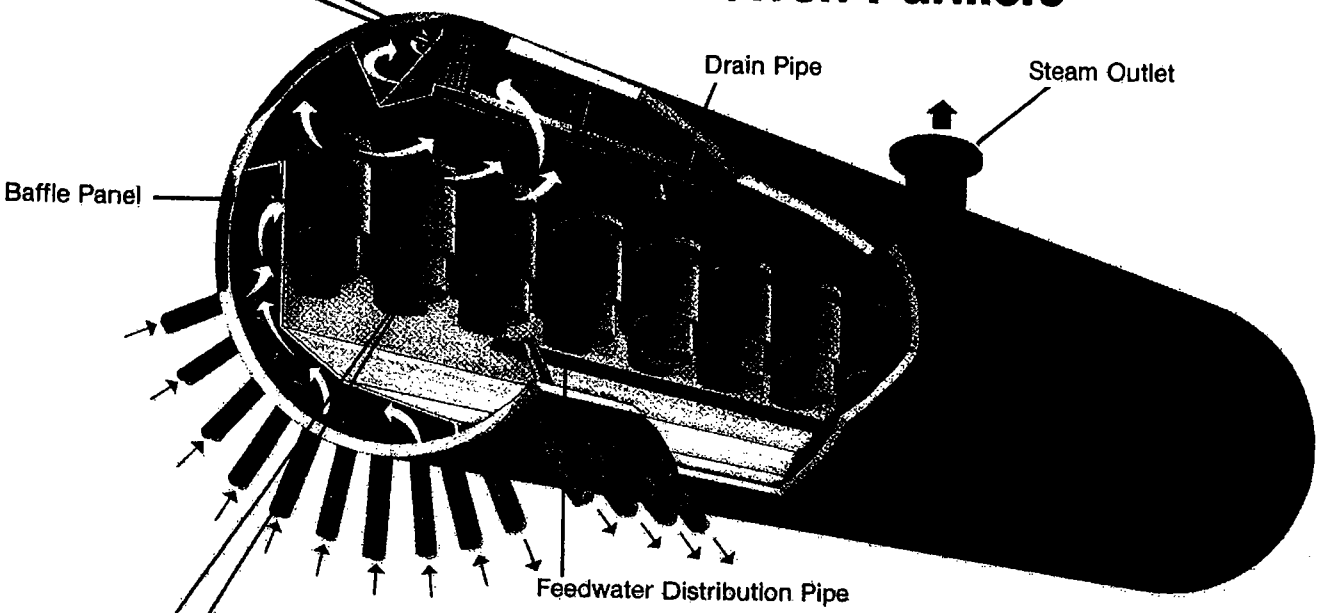
Customers Drive Our Business

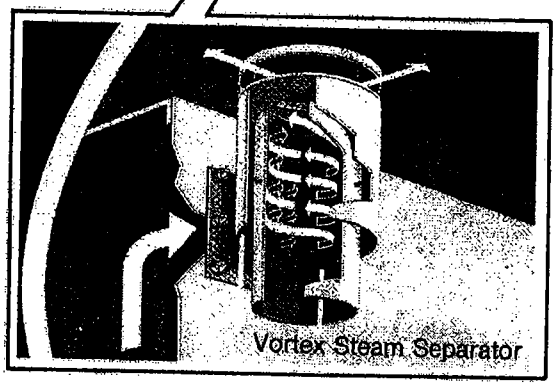
Para konsumen memacu bisnis kami • El cliente es el motor de nuestra empresa.
고객은 우리 비즈니스의 원동력입니다. • 客戶是我們成長的動望 • الزبائن يسيّرون صناعتنا

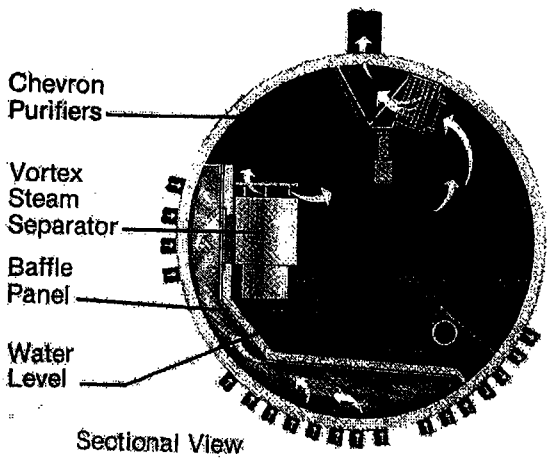


Zurn Steam Purity Components

Baffled Drum with Vortex Steam Separators and Chevron Purifiers







Sectional View

Zurn Industries, Inc., Energy Div. has extensive experience and expertise in providing high-quality, high-purity steam. Steam separation and scrubbing components are designed for specific requirements and are compatible with any Zurn steam generator.

In this arrangement, which combines Vortex steam separators and Chevron purifiers, steam and water enter through ports into Vortex steam separators where water is separated by centrifugal action and gravity. Steam rises and flows through the Chevron purifiers, where direction of flow is continually reversed so that any residual water droplets or condensate cling to scrubber plates, collect and return to recirculating water.

Vortex separators are an integral part of the steam generator circulation system. Vortex separators will stabilize steam drum level during transient conditions and maximize circulation by insuring positive separation of steam from water flowing to downcomers.

Vortex separators and Chevron purifiers can be applied to any Zurn steam generator or process steam drum and will provide highest steam purity.

ZURN *a step ahead of tomorrow*

ZURN INDUSTRIES, INC.
ENERGY DIV.
1422 EAST AVE.
ERIE, PA, U.S.A. 16503
PHONE: 814/452-6421
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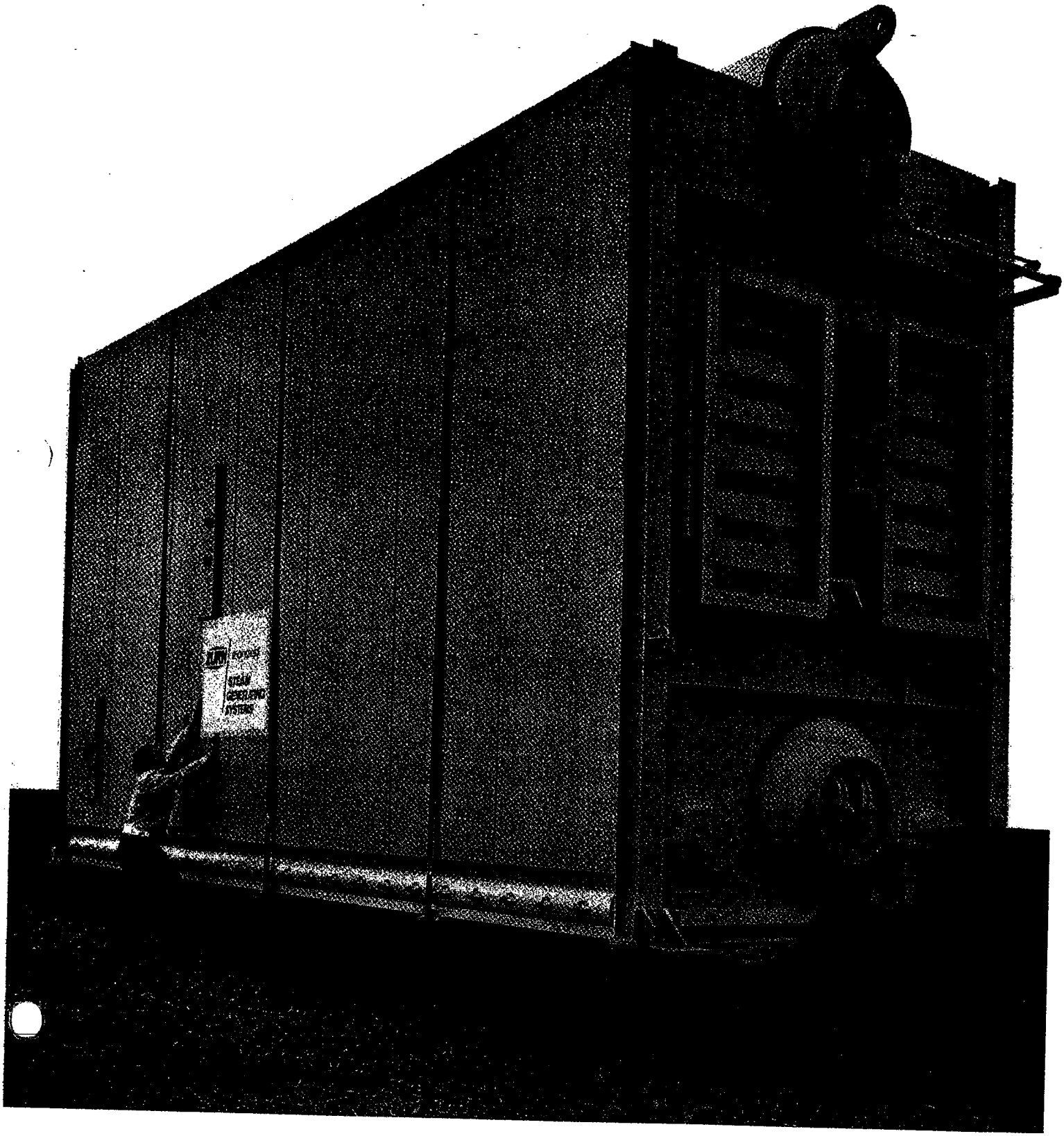
Form No. SG-6, 2/79

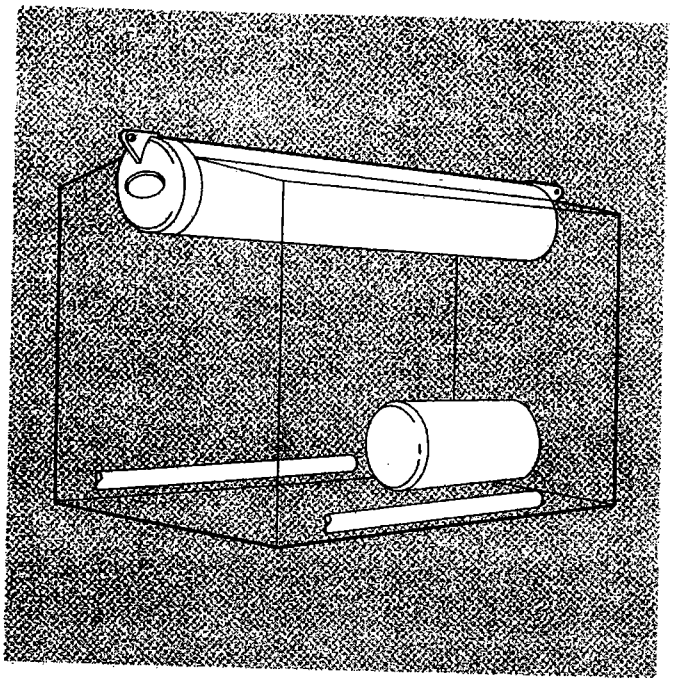
ZURN a step ahead of tomorrow

Zurn "VL" Watertube Steam Generators



VEO9278

The Zurn "VL"...Each, Custom-Designed to Customer Requirements



Ever-increasing costs and lower availability of certain fuels have focused increased attention on systems that produce efficient energy at lowest cost. Zurn Industries, Inc., Energy Div. offers a watertube steam generator that provides custom design at competitive cost for any installation. The basic design of the Zurn "VL" consists of a longitudinal steam drum that runs from front to rear casing, a lower drum that runs from the bridgewall to the rear casing, two lower headers that run along the furnace side walls, and 2½" OD water tubes that connect the drums and headers, forming a natural circulation steam generator (See illustration at left). All other elements — fuels, firing systems, wall construction, furnace and convection dimensions — are dictated by customer requirements. Each "VL" installation is the creative combination of numerous alternatives, custom-designed to a unique situation.

Zurn has custom designed, engineered and constructed hundreds of "VL" installations, ranging in capacity from 10,000 to 50,000 pph. Included on this page (below) and on the opposite page are some of the most creative design arrangements utilized for efficient energy production.

Left — Basic "VL" design provides wide flexibility to customize unit for firing a variety of fuels.

"VL" Design Arrangement "A"

Fuel: Hogged Wood, typically 20-50% moisture as fired

1. Front Wall — castable refractory (field installed)
2. Pneumatic Fuel Distributors
3. Setting — Columns for additional furnace volume.
4. Side Walls — spaced wall tubes
5. Convection Baffles
6. Bridgewall — Field-erected
7. Circulator Tubes — short feeder tubes run from lower drum to feed sidewall headers.
8. Firing System: Air-cooled, pin-hole Grate (Optional water cooled, pin-hole grate system available.)

"VL" Design Arrangement "B"

Fuel: Eastern Hemlock, typically 50% moisture, as fired

1. Front Wall — water cooled
2. Designed for Future Oil/Gas firing (plugged)
3. Setting — Legs to accommodate fuel cells
4. Side Walls — spaced tubes
5. Convection Baffles
6. Bridgewall — Field-erected
7. Circulator Tubes — short feeder tubes run from lower drum to feed side wall header.
8. Furnace Section — Extended due to space requirements of fuel cells
9. Firing System: Fuel Cells

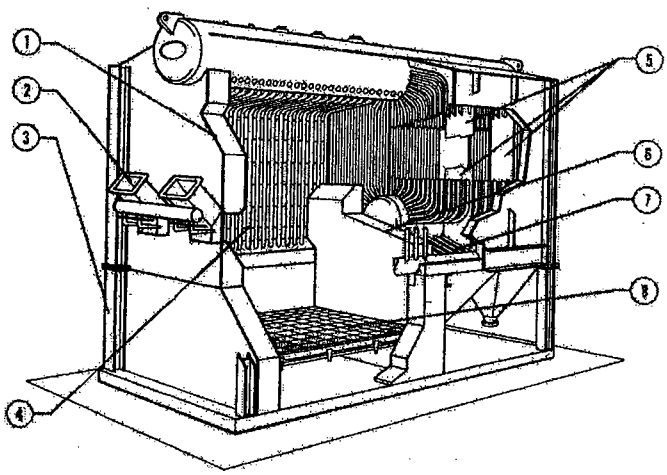


Fig. "A": 25,000 pph Wood-Fired "VL" with Air-Cooled, Pin-Hole Grate

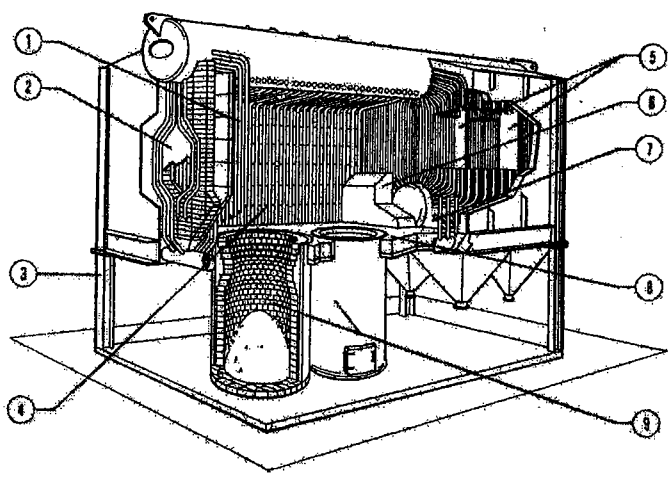


Fig. "B": 25,000 pph Wood-Fired "VL" with Fuel Cells

The Zurn "VL" . . . Covers A Wide Range Of Fuel Alternatives

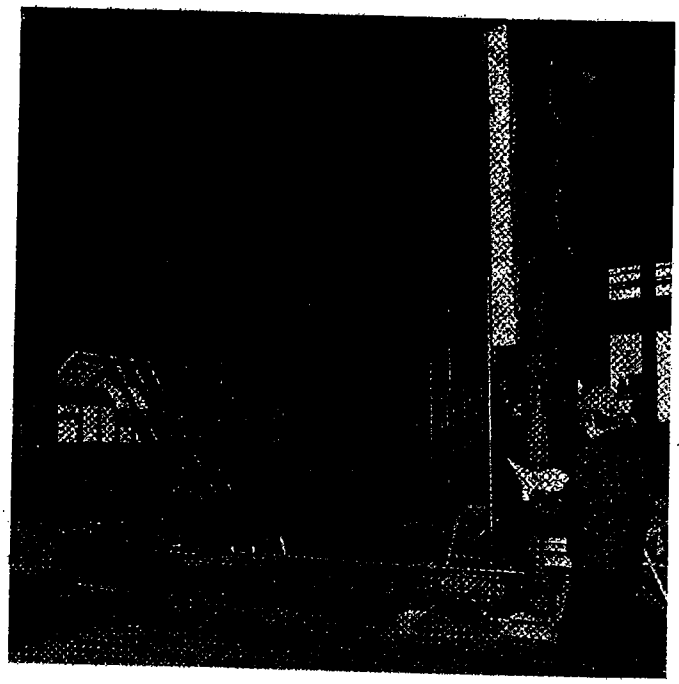
The most important design parameter for any steam generator is the exact makeup of the fuel to be fired. The Zurn "VL" can be designed for a wide range of fuel alternatives covering wood, coal, oil and gas — including combinations and/or future firing situations.

Precise fuel specifications are essential to maximum custom-design because the fuel to be fired sets the tone for what firing system is to be used, and dictates many sizing and construction specifications.

Once the fuel is specified, Zurn designs, engineers and constructs a custom "VL" to meet customer requirements.

Ideal For Solid Fuels

Today's higher prices and lower availability of gas or oil coupled with an abundant supply of wood waste and coal have forced many to consider solid fuel firing as an energy alternative. The Zurn "VL" is an ideal solution to solid fuel firing. It can be designed to burn oil/gas now . . . and wood or coal in the future . . . or vice-versa. The "VL" can also be designed to burn wood or coal exclusively as well as many other solid fuels.



Right — Custom design features such as water-cooled bridgewall & front wall and tangent furnace & convection tubes are completely factory-assembled.

"VL" Design Arrangement "C"

Fuel: Coal

① Front Wall — spaced tubes
② Mechanical Coal Feeders
③ Piers (Field-erected) — to accomodate stoker plenum and hoppers
④ Furnace Height — Constructed to maximum height (rail clearance)
⑤ Side Walls — Tangent furnace tubes
⑥ Bridgewall — Factory-assembled, water-cooled and insulated
⑦ Side Wall Headers — extend entire length with tubes feeding each header directly from lower drum
⑧ Firing System: Vibrating Conveyor Grate

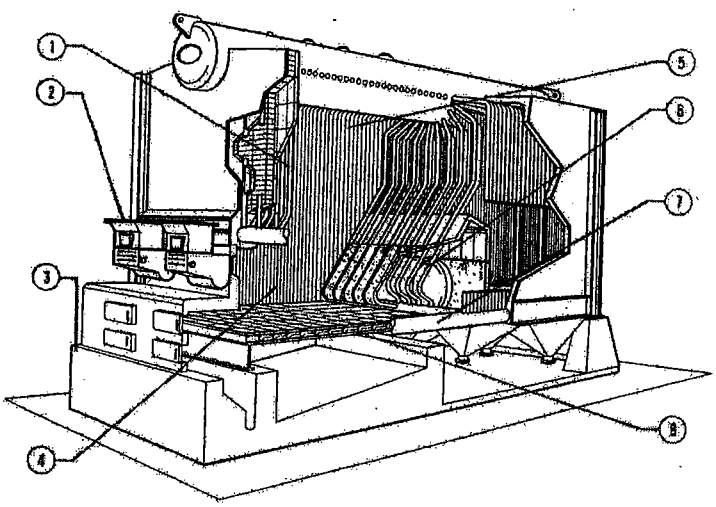


Fig. "C": 40,000 pph Coal-Fired "VL" with Vibrating Conveyor Grate

"VL" Design Arrangement "D"

Fuel: Coal

① Front Wall — spaced tubes
② Mechanical Coal Feeders
③ Piers (Field-erected) — to accomodate stoker
④ Furnace Height — constructed to maximum height (rail clearance)
⑤ Side Walls and Bridgewall — Spaced Tubes
⑥ Convection Baffles
⑦ Circulator Tubes — short feeder tubes run from the lower drum to feed side wall and bridgewall headers
⑧ Firing System : Zurn "Travagrate" Spreader Stoker

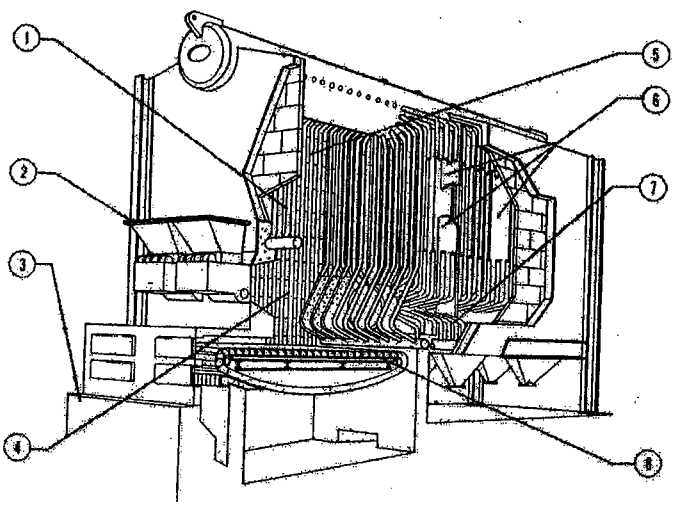
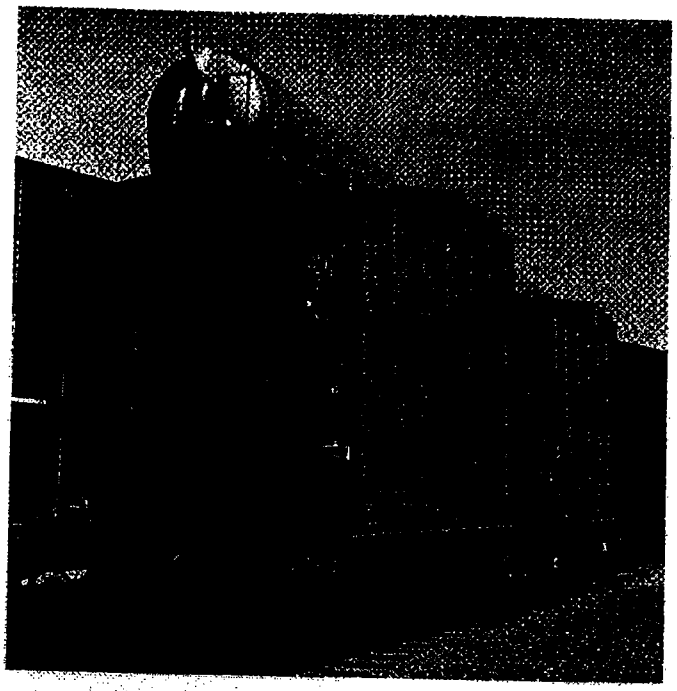
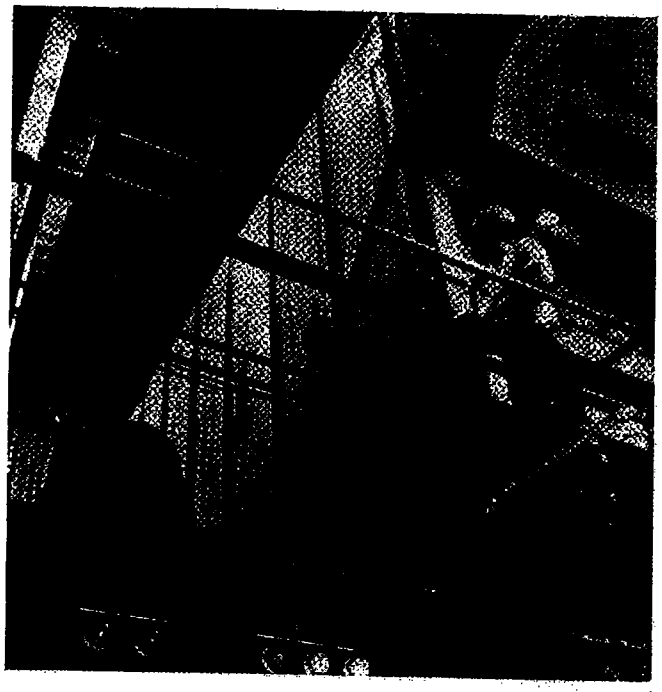


Fig. "D": 30,000 pph Coal-Fired "VL" with "Travagrate" Spreader Stoker

Zurn "VL" Installations

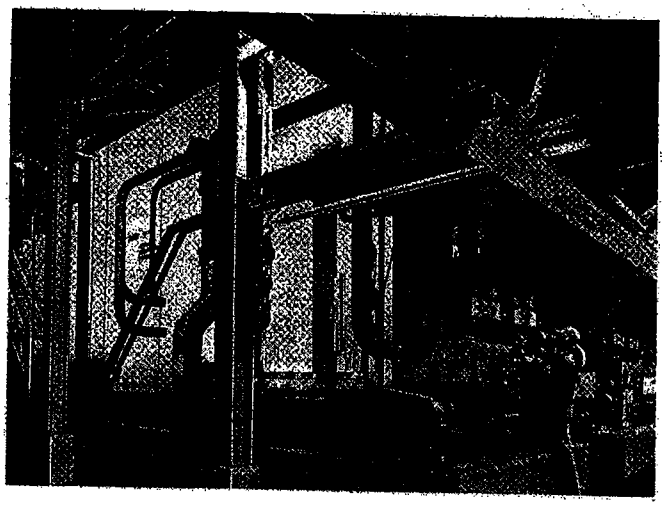


Two Zurn shop-assembled 25,000 pph wood-fired steam generators ready for shipment.



A 25,000 pph wood-fired "VL" in operation at an Eastern Pennsylvania wood processing plant.

Two of three 40,000 pph wood-fired "VL's" disposing of wood waste and providing energy for a California saw mill.



Two 40,000 pph coal-fired units ready for operation at a Colorado mining facility.

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ZURN INDUSTRIES, INC.
ENERGY DIV.
1422 EAST AVE.
ERIE, PA. U.S.A. 16503
PHONE: 814/452-6421
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